THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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	Page
Australian Trade	241
The Propulsion of Ships	242
Foreign Trade Returns	243
Berlin Railway Proposals	243
What is an Electrical Installation?	243
Notes from Canada	244
Belgian High-Tension Testing Laboratories (*illus.*)	245
Correspondence:—	
Municipalities and Contractors at Cape Town	247
The Bray Explosion	248
International Electrotechnical Commission	248
Proceedings of Institutions:—	
The Association of Consulting Engineers	251
Wire Ropes for Lifting Appliances	251
The Commercial Utilisation of Peat for Power Purposes	252
The Parks Electro-Cyanide Process (*illus.*)	253
Parliamentary	254
Australian Trade	255
Legal	255
Business Notes	256
Notes	263
City Notes	264
Market Quotations	268
Stocks and Shares	268
Share List of Electrical Companies	269
Electrical Applications of Reinforced Concrete (*illus.*)	271
The Melbourne Railway Electrification	272
Italian Exports of Electrical Goods	273
Mechanical Troubles with Tramcar Brake Gears	273
Rules for Electric Operating Staffs	274
National Insurance Act, 1911	275
Boiler Settings	277
An Interesting Storage Battery Car (*illus.*)	279
Engineering and Mathematics	279
New Patents Applied For, 1912	280
Abstracts of Published Specifications	280
Contractors' Column ...Advertisement pages xxii and xxiv	

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AUSTRALIAN TRADE.

IN a short notice last week we called attention to a new phase in the Australian attitude towards British trade which was destined to have an important effect, and were pleased to congratulate Mr. Hamilton Wickes, the former Trade Commissioner in Australia, to whose activities this new phase is due, on the excellent work he has done in the interests of British firms. We have since had an opportunity of discussing this and other Australian questions with Mr. Hamilton Wickes himself, and can more fully appreciate the value of his work in Australia and the direct beneficial results which it should produce.

It is common knowledge that for some years certain foreign firms, and notably Krupp's, have been securing a large amount of business in Australia for all classes of goods, but most of all for supplies to the various State railway authorities. For our purpose it does not much matter now to what causes this result may be attributed—whether to the activities of foreign agents, the lack of enterprise of our own, or a wrong impression in Australia as to the relative qualities of British and foreign material. It is sufficient that British firms had not been doing the business they should, and that one order to a foreign firm had been adequate precedent for another, and yet another, until it had become almost a habit of the various buying authorities to specify German brands and manufactures.

To tackle such a situation meant no small amount of courage and not a little tact. Fresh from our interview with Mr. Hamilton Wickes we can understand why he succeeded where others might lamentably have failed. At the same time it must be said in all fairness that immediately the facts became known every true Australian supported the attitude that the Mother Country must be given every opportunity of supplying such of the needs of the Commonwealth as could not be supplied from within. Mr. Hamilton Wickes particularly acknowledges the sympathy he received from Mr. Watt, the Premier of Victoria, and the courageous stand taken up by the *Melbourne Age* in favour of British manufactures. The grasp of highly technical matter displayed by Mr. S. W. Biggs, of the *Age*, was particularly useful.

It would seem almost foolish to say here that in railway material of all kinds British goods are quite as good, if not better, than any that can be produced abroad. But Australia is a very long way off, and for some unaccountable reason the impression has prevailed there, at any rate, amongst the buyers immediately responsible, that some special qualities attached to German materials which were unknown to British. With the co-operation of the Board of Trade at home it was possible to prove that on all the first-class railways of the world British material had been and was being used in very large quantities. A careful examination of methods of buying in Victoria showed that a system had grown up "by which orders that with reasonable business precaution might have been placed with British manufacturing firms have been placed with foreign tenderers." As the result of long and close investigation, which revealed an unsatisfactory state of affairs, this system

received the consideration of the Victorian Cabinet, and it was decided to give certain directions to the buying authorities for future work.

We quote these directions at length on another page, and consider that they should receive the careful attention of all British firms, and particularly contracting firms interested, or likely to be interested, in the Australian market. The first direction states definitely that "taking into consideration the quality, time of delivery and price of the goods, orders are to be given to British manufacturers as against foreign tenderers." Furthermore, when orders are given abroad the buying authorities responsible must "explicitly state" their reasons. This was the attitude which it was desired the Government should take up, but in its patriotic enthusiasm a great deal more was given. We have for some time agitated for longer periods to be given for the submission of tenders in our self-governing Dominions. The Victorian Government have now laid down that the time during which tenders will be admitted shall be long enough to allow of specifications being sent home by mail, and tenders being sent back by mail. This is a concession, the importance of which to British manufacturers cannot be overestimated. At the same time, it will be no less an advantage to the Victorian Government. Other directions provide for the acceptance of the lowest tender in all cases unless specific and adequate reasons are given for adopting another course; for the limitation of the purchasing powers of the railway buying authorities without public calls for tender; and for the giving of trial orders to such reputable firms as have not previously contracted for supplies to the Railway Department.

It will be seen that the above-named directions apply only to the Railway Department, but the principle of preference to British tenderers has been adopted by the Government for other Departments. Moreover, we are assured by Mr. Hamilton Wickes, and we have also heard in other directions, that the effect of the movement which has been started in favour of British trade is not limited to any section of the community either public or private, but that in other States besides Victoria, the same feeling exists. From the point of view of the electrical trade, this is a matter of great and far-reaching importance. Apart from the electrification of the Melbourne Suburban railways, tenders for which are now on the board, electrical development in all parts of the Commonwealth, and in all branches of life, is rapidly increasing. Continental and American firms are regarding with considerable anxiety the new position which has been so speedily established, and if there ever was a time when opportunity offered itself for British firms to gain a firm and unassailable standing that time is now.

Our interview with Mr. Hamilton Wickes has been very illuminating, and has covered a range of subjects which it would be impossible to discuss here. It has confirmed us in a number of views we have set forward from time to time, and it has added others which could only be formed by close touch with Australia. We regret that Mr. Wickes is leaving Australia, we regret that his present stay is England is short, but we would urge our large electrical firms who have interest in Australia, to see him and reap the advantages of a close insight into Australian conditions. Mr. Hamilton Wickes is of the opinion that our selling organisations in many cases need a close examination and improvement. From our knowledge of the methods of some Continental and American concerns, we are inclined to agree with him. It is only natural that there are some things which he could tell private firms which it would not be right that he should tell us, and we hope that these firms will see him now at a time when conditions are particularly favourable to British trade in the Commonwealth.

For the Australian attitude now expressed we have nothing but praise. It will mean advantage to us, but it will also mean advantage to Australia. The new Trade Commissioner must be in a position to advance the work Mr. Hamilton Wickes has begun. Meanwhile, it is "up to" British firms to see that the trust that is being placed in them is not betrayed and that some recognition of the Victorian Government's action is forthcoming, so that the Commonwealth, as a whole, may be assured that we appreciate the direct impetus which is being given to British interests in this important market.

THE PROPULSION OF SHIPS.

All great movements of necessity progress slowly, and especially is this true of matters connected with the marine world, where the force of conservation has from time immemorial been strongest. An impending revolution in the methods of ship propulsion has, however, been clearly foreseen for many years past by most of those who had sufficient knowledge to understand all sides of the question, and were unbiassed enough to be able to keep outside the prejudices of bygone ideas.

It has for so long been customary to look upon Great Britain as the natural pioneer in all matters connected with the sea, that the little band of enthusiasts who have continually been urging that greater attention should be paid to the great impending changes in ship propulsion, were regarded as little less than fanatics. In the last year or so, however, it has become apparent to even the least initiated that the question of new types and arrangements of ships' machinery could no longer be neglected, and one of the results—belated as it is—has been the recent appointment of a Royal Commission to inquire into the oil supply question and the future methods of the propulsion of ships.

The success of the *Selandia* and other oil-engine driven ships has led some who are insufficiently acquainted with the subject to assume that the whole of the difficulties in the construction of marine oil engines have been satisfactorily overcome, and that we are on the immediate eve of the motor-driven battleship. Such an assumption is almost as detrimental as the obstinate pessimism of these same people. It is necessary to face the fact that in this country at any rate, we are very little nearer the production of an oil engine suitable for driving a battleship than we were five years ago. Unfortunately, however, the matter is different on the Continent, where engines of far larger size than those contemplated in England are already constructed and under test. Such is the position which confronts the Royal Commission, and unless it tackles the problem boldly and radically, it must inevitably fail in its purpose and fail badly.

From the composition of the Commission one is apt to conclude that too much attention will be devoted to the minor question of the improvement of oil-fired boilers, and that more important matters will be side tracked as being beyond the scope of the inquiry. In this connection it would have been preferable had it been clearly stated that the investigation was to cover an examination of all possible methods of propulsion including the electrical driving of ships. This matter has already been taken in hand in a practical manner by shipowners in this country and by the United States Naval Authorities, but has certainly not received great consideration by our own Admiralty. Whilst stating that the subject of electric driving should be tackled by the present Commission, we must not be understood to be advocating its employment in battleships. It must be admitted that the great success which has attended the directly reversible marine oil engine has somewhat altered the case as regards the necessity of the electrical system, but there are undoubtedly certain instances where it could with advantage be adopted. It is also possible that until the very high-powered oil engine has been thoroughly developed, electrical transmission might be employed with advantage on large war vessels in conjunction with steam turbines, but this would in all probability be but a transition stage.

Everything, however, depends on the oil supply. If this is not likely to be sufficient for all the demands which would arise in the event of the oil engine being universally adopted for warships, then the whole matter assumes yet another aspect. The oil engine in that case as a means of propulsion is condemned *ab initio*, and it seems then that the employment of electro-mechanical propulsion must be most seriously considered. It is impossible to continue indefinitely with the present uneconomical method of direct steam turbine drive, which is far too inefficient for the present stage of develop-

ment, and it is beyond all doubt that a very considerable saving could be effected by the electrical method, more particularly in large war vessels, which are operating so uneconomically during practically the whole of their service. There are no insurmountable difficulties, since all the factors are known, and the problem is far too serious to be lightly passed over.

The first duty of the Commission seems, therefore, to be to ascertain the exact present and future position of the oil supply. If there is to be a shortage in the oil supply, then the Commission should turn its attention to the improvement of the economy of existing methods of propulsion, which means an investigation of the various methods of transmission—electrical, mechanical and hydraulic. If, however, the conclusion is arrived at that the oil supply is likely to cope with all demands, attention should be concentrated on the direct drive of the largest war vessels by oil engines.

It is more than likely that the Commission will be unable to come to any very definite conclusion on the oil question as the factors are so diverse, and the uncertainties are numerous. In that case, the only course seems to be a consideration of all the possible methods of propulsion enumerated above, with the exclusion of none. What is vitally important, however, is that the matter be investigated in the very broadest spirit, and that all side issues be rigorously avoided, since the scope of the inquiry is far too wide to allow valuable time to be spent in discussing matters which really do not affect the final issue. And it cannot be too strongly urged that time is a most important consideration; so much so, that it would be preferable to reduce the matter under discussion rather than delay the issue of the report of the Commission.

Foreign Trade Returns.

There is every reason to be satisfied with the returns just published for our foreign electrical trade during the month of July, as well as for the full seven months of the year to date. The following are the figures :—

Imports :—

Electrical goods and apparatus other than machinery and telegraph and telephone wire. For the month of July, £96,659, a decrease of £9,886.

Ditto. For the seven months, £818,480, an increase of £23,415.

Machinery. For the month of July, £553,811, an increase of £127,334.

Ditto. For the seven months, £3,981,186, an increase of £406,061.

Exports :—

Electrical goods and apparatus (as above). For the month of July, £293,413, an increase of £105,713.

Ditto. For the seven months, £2,359,746, an increase of £817,613.

Machinery. For the month of July, £2,758,505, an increase of £535,895.

Ditto. For the seven months, £18,447,691, an increase of £495,673.

So that in electrical goods and machinery items together export values for the year, so far as it has gone, have advanced by £817,613 and £495,673 = £1,313,286, which is not bad when we remember that this year has been attended with widespread industrial disputes practically from the beginning, whereas last year the railway and transport strike only began late in July. Taking the gross figures, the imports for 1912 down to date reflect an advance of 27 millions, the exports an advance of nine millions, and the re-exports one of getting on for two millions. In respect to the total import figures, these are affected to some extent by the higher food prices. In the interests of manufacturing we may hope, and probably with some reason, that the export figures for articles wholly or mainly manufactured, which are better in value by £5,059,584, are also affected by better prices. What we want to maintain in the electrical industry is an increasing volume, with a more than correspondingly increasing value, in the matter of exports, for, unfortunately, it is complained that export prices, though better than those in the Home market, are not so satisfactory as they should be. With the increasing burdens that are now put upon our manufacturers and the higher cost of raw material and labour, selling prices must inevitably rise, especially in the electrical industry, and to some extent the electrical export values will be higher in consequence, but an increase of £105,713 in electrical goods sent out during the month means a fine advance in volume as well as higher prices, and being, we believe, the result of the greater activity of our manufacturers and traders, it is a cause for gratification. We hope that the rate of advance will long continue, for, as we have said repeatedly, there is still almost unlimited scope, notwithstanding the greater attention that our own and other firms have been paying to the world's requirements in recent years.

Berlin Railway Proposals.

The *Railway Gazette* correspondent in Berlin recently referred to the postponement of the report on the electrification of the Berlin City Railway, which he attributes partly to the possibility that the results obtained with the electric locomotives on the Bitterfeld line have not come up to expectations, and partly to the action of the German locomotive builders, who claim that the superheated steam locomotive has not been properly tested against the electric locomotive—it having been proposed to operate the Berlin lines with locomotives in preference to motor-cars. It appears that the locomotive manufacturers on hearing of the proposed conversion, immediately petitioned the Prussian Minister of Railways to discuss with them the relative merits of the rival traction systems.

If all the technical points of superiority urged in favour of the superheated steam locomotive by its makers could be accepted, there would be little to be said for the electric locomotive, but disregarding a naturally biased view, the most important point urged against the electric traction proposal is the expenditure, representing both capital and working cost.

But bare figures of cost, such as are given, are really insufficient to discredit the prospects of electric traction, which experience shows has far wider claims to consideration than are indicated by the "facts" which the rival interests have placed before the Prussian Minister.

The matter is of some interest to railway men in this country, and particularly in London, where electric traction is so rapidly ousting steam traction on all heavy traffic lines, and with such excellent results from the traveller's point of view, that the idea of steam operation on city railways such as the Metropolitan and District is now quite untenable.

Our contemporary appears to think that the Berlin postponement is principally due to the feeling of doubt on the question of system, "overhead" direct-current having now entered the field as a competitor of the alternating and third-rail systems. For ourselves, we shall be somewhat astonished if the single-phase system is set aside at Berlin in view of the unanimity with which it has been adopted by Continental railway authorities, but political and military considerations may obscure the purely commercial and technical sides of the question.

What is an Electrical Installation?

The question as to what does and what does not constitute an electrical installation has recently been very prominently discussed in Australia. It is well known that in the Australian States labour questions have during the past few years been very sympathetically considered. Under a Labour Government, legislation has been very active and the legally fixed wage has been applied to many industries. Whatever the final result may be the immediate effects of many of these enactments have been far from satisfactory. A fictitious value has been given to money, and though wages have risen the general testimony is that the cost of living has risen in a far higher ratio.

The dispute as to the meaning of the term "an electrical installation" arose as follows :—Under the Victorian "Factories and Shops Act" a Wage Board was formed to deal with electrical installations. This Board consisted of three wiring contractors and three wiremen, and it contended that it had full powers to decide the wages and conditions that should prevail in connection with the whole of the electrical under-

takings in the State of Victoria. It will be noticed that the electricity supply undertakings had no representative on this Wage Board, although the capital and the number of employés controlled by these undertakings were considerably in excess of the comparatively small industry comprising installation work in the State. This Wage Board issued a "Determination," which came into force on the 11th of last March. It decided "the lowest prices or rates which may be paid to any person, persons or classes of persons wheresoever employed in any business or occupation connected with the installation of electrical fittings, appliances, motors and heaters, including the laying of wires."

The principal awards were a minimum wage of 63s. per week of 48 hours to electrical mechanics or wiremen, 66s. per week to electrical fitters, 69s. per week to cable jointers, 63s. per week to persons engaged in patrolling and effecting repairs to external electric supply or transmission mains, and 54s. per week to electrical labourers and assistants. There were in the "determination" a number of other clauses dealing with hours, overtime rates, and payments to boys, apprentices and improvers.

The Wage Board's claim to control the working conditions of the whole electrical industry has, ever since its appointment, been disputed by the various electricity supply undertakings, with the result that they have declined to recognise the award. As one result, however, of their joint representations, the Minister of Labour has agreed to form a new Wage Board, on which the undertakings will be represented to deal with the employés of these undertakings.

Notwithstanding this, the State Factory Inspectors have proceeded against the Electric Supply Co., of Victoria, Ltd., for breaches of these regulations, and two test cases were recently decided, one at Ballarat, on the 6th ult., and one at Bendigo, on the 8th ult. In both cases the claim was that employés of the supply company had been engaged in installation work and paid less than the rates declared legal minima by the "determination."

At Ballarat the charge was that the workman who connected the company's mains to the consumers' and fixed the meter was engaged in installing the light. The company contended that the work of installation began at the meter and consisted in the fitting up of the wires on the consumers' premises and the fixing of all lamps and electrical fittings. They were a statutory company supplying electrical energy, and inasmuch as they had to be satisfied, by test or otherwise, that the contractors did their work satisfactorily before they would supply energy, they and their employés were not in the same category as ordinary electrical contractors. In one instance, the workman mentioned in the charge had been engaged in work to which the term installation work might be applied, and for this he had been paid at the award rates. Further, the fact that the Minister of Labour had agreed to the formation of a new Wage Board for their employés showed that they were not bound by the existing award. The Court held that the company had established their case that they were outside the award, and dismissed the case.

At Bendigo the following week the charge against the company was that a labourer who was employed in effecting temporary repairs to consumers' wires and lamps should be paid 54s. per week, whereas he was only receiving 40s. per week. It was proved that the man's regular work was recarboning arc lamps. He had done this work for 4½ years. Until recently he had described himself as a trimmer, but latterly had altered the designation to "private arc attendant." On two occasions the man disconnected a lamp, and replaced a negative lead. The inspector claimed that this brought the work under the terms of the award, inasmuch as it was installing the light. The company, however, resisted this interpretation, and elicited from the witness that until he was overruled by the chief inspector he was of their opinion, and had even told the man he was outside the award. In the end the company were successful, and the charge was dismissed.

We are of opinion that the company were right in their course of action, and that "technically" an electrical installation commences at the meter terminals. The point has not become important in this country, but similar difficulty may at any time be experienced, and it is well that the distinction should be clearly established.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

News from Western Canada states that the Hart Accumulator Co., of London, have under consideration the establishment of a branch works over here at Winnipeg, or Fort William, which is in the Province of Ontario, though it lies some 450 miles west and 300 miles north of Toronto, on the shores of Lake Superior. At Port Arthur, which is only a few miles from Fort William, it is reported that another British firm—Ham, Baker & Co., of Westminster—will erect a factory.

The City of Regina, Saskatchewan, is asking for tenders for electrical plant, the closing date being September 14th. Specifications may be obtained at the office of the City Electrician. A certified cheque for 5 per cent. of the amount of the tender is required.

The Provincial Government of Ontario has recently benefited by a decision of the Privy Council at home by about $100,000.

Different interpretations of the agreement between them were made by the Government and the Power Companies at Niagara Falls respectively. The Privy Council upheld the view taken by the former, and it now appears that back rentals amounting approximately to the sum named are due from the companies.

The Montreal Electrical Society has adopted a novel scheme for increasing its membership. Existing members are to be divided into two sections called "Volts" and "Amperes," the idea being that they shall compete in the effort to obtain new members, thus introducing the stimulating effect of rivalry.

The power and lighting plant of the City of Edmonton, Alberta, will, according to report, very probably have to be replaced, as it is not sufficiently modern to suit present requirements.

Like many other Western towns, Medicine Hat, Alberta, is developing very quickly, and the city generating plant must keep pace with the requirements—$10,000 is to be spent on extensions.

Wear on the Trolley Wheel.—The reduction of wear and tear in traction systems is a very important factor of efficient maintenance. A large amount of such deterioration is, of course, inevitable owing to the severe conditions under which the plant is frequently called upon to operate, involving irregular loads due to gradients, starting and stopping and also due to dirt and wet weather. At the same time there is no doubt that the wear can be diminished considerably if due attention is paid to the restoration of worn parts at as early a date as is consistent with considerations of prime cost, and also if means are taken to avoid unduly increasing the wear by improper use. The design of electric traction equipment has now progressed to such a stage that the majority of the parts which suffer severe wear can be replaced at very small cost, and thus there is not much excuse for highly concentrated forms of wear and tear occurring at particular portions of the equipment, owing either to bad practice from the commencement or to postponement of overhaul, allowing accumulation of wearing action to take place. One of the parts of the traction equipment at which the largest amount of wear takes place is the trolley wheel, and care should be taken to see that the wheel is not exposed to anything more than the inevitable minimum of attrition. In one case it was noticed that a new trolley wheel fitted to a trolley head was worn out very rapidly, and upon examination it was discovered that this was due to the fact that there was too much tension on the trolley. Some little time previously the trolley standard had been overhauled and the tension on the springs had been put on by guess-work. The wear on the trolley wheel drew attention to the matter, and on measurement, it was found that the tension was as high as 42 lb. When it is mentioned that the trolley tension for centre running should not exceed 20 lb., while for side running it is not necessary to have more than 25 lb., it will be seen how very seriously increased was the tendency to wear on this part of the equipment. When trolley standards and their subsidiary parts are being renewed, the trolley tension should be measured with a spring balance tied to the trolley rope, care being taken at the time of measurement to keep the trolley head at the normal height of the overhead wire. The tension on the springs can then be adjusted until the reading is just sufficiently high to avoid undue flashing and sparking of the wheel as it passes the more awkward points on the route. Attention to this small detail will, in the course of a year, show a considerable difference in the bill for new trolley heads.

BELGIAN HIGH-TENSION TESTING LABORATORIES.

By Dr. ALFRED GRADENWITZ.

The high-tension testing laboratory of Messrs. De Fuisseaux, at Baudour, Belgium, formerly comprised a 10-K.V.A. 220-110,000-volt transformer which, however, eventually proved insufficient for the work, especially for testing the insulators of high-tension transmission lines. The managers of the works, therefore, decided on installing a new testing laboratory, the electrical equipment of which, as supplied by the Ateliers de Constructions Electriques, of Charleroi, consists mainly of a static transformer with its pressure regulator and testing troughs (fig. 1).

The single-phase transformer is designed for a normal permanent output of 50 K.V.A. at 250 volts primary and 250,000 volts secondary pressure and 40 cycles per second (fig. 2). A special point was made of ensuring a constant ratio of transformation with any load, absolute safety in working, and prolonged loading without any material heating.

The housing of the transformer consists of iron sheets of very ample dimensions assembled by riveting. Its useful capacity is about three tons of oil. It is provided at its lower part with an oil outlet and at its top with an oil level.

The cast-iron lid is bolted to a flange riveted to the housing. It carries the four terminals of the primary windings. On the top are five circular openings to receive the high-tension terminals, and two filling openings. Two suspension hooks have been provided.

The magnetic circuit of the transformer consists of two cores and two yokes of soft iron sheets of great permeability, ·35 mm. in thickness. The primary winding consists of two coils (one for each core) which only comprise one layer of turns wound on an insulating tubular armature. Between the primary and secondary coils are arranged several concentric tubes of a special compressed insulating material between which there is a free circulation of oil. The secondary winding comprises a set of series-connected coils concentric to the primary coil on each core. These coils are separated from one another by varnished card-board tubes; they are fitted between the yokes by means of two superposed rows of fluted porcelain insulators arranged on thick wooden disks impregnated with insulating varnish. These different parts are so arranged as to allow the oil ready access to all parts of the windings.

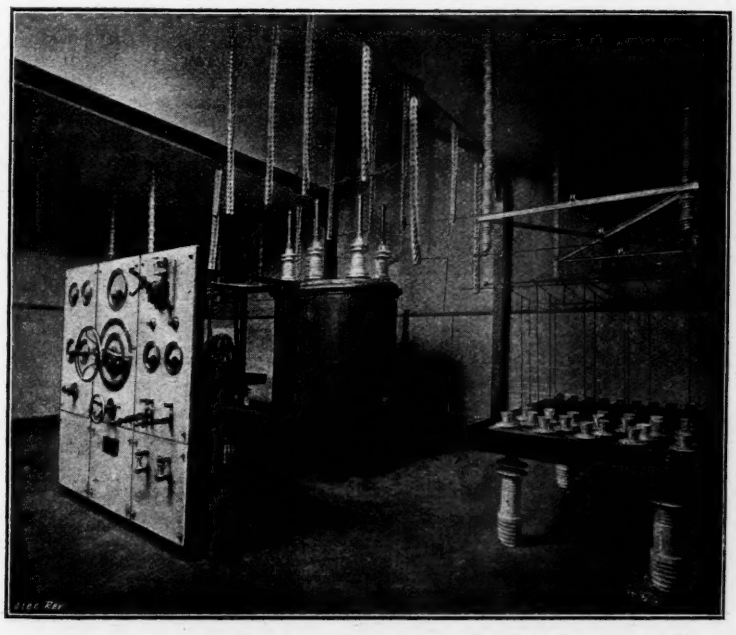


Fig. 1.—View of the De Fuisseaux Testing Laboratory.

The manufacture of the high-tension coils offered special difficulties because of the cross-section of the wires and the considerable number of layers superposed in each coil with a small height and considerable diameter. The terminals of the primary and secondary windings of each core are connected up to low and high-tension terminals arranged on the lid. The two primary coils are thus connected up in series by means of the low-tension terminals.

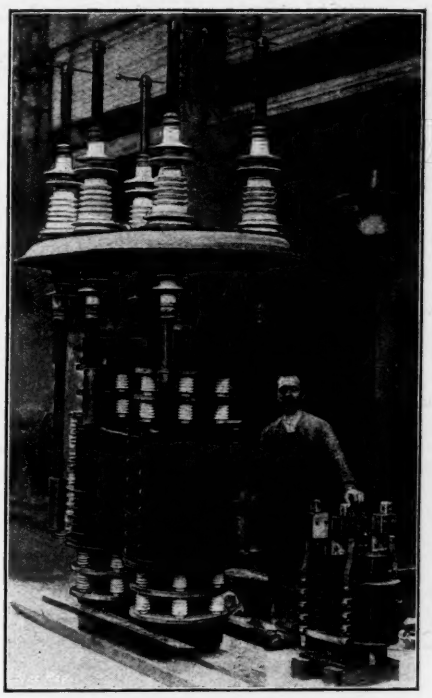


Fig. 2.—Transformers for 50 K.V.A., 250,000 volts and 250 volts

The high-tension terminals (fig. 3) consist of three parts, viz., first, a tube of compressed insulating material containing in its interior the conductor; secondly, a concentric porcelain insulator fixed to the lid; and thirdly, the terminal proper of polished brass which is fitted on the insulating tube.

The insulating tubes separating the primary and secondary windings as well as those of the terminals were produced by the aid of special machinery designed by the Ateliers de Constructions. They have a very high dielectric constant and great mechanical strength, and are so impervious to oil that these large tubes are free from any deformation and can be kept indefinitely in the outside air as well as in a hot oil bath. Before being mounted they were placed repeatedly in a furnace at high temperature and submitted to a vacuum.

The porcelain insulators, constructed by the Societé des Usines De Fuisseaux, are in four separate parts, viz., an outside cover to which the bronze ring for fixing the terminals to the lid is attached, a fluted tube traversed by the insulating tube, and two high-tension tubular insulators with two superposed sleeves. The metal cap constituting the top of the high-tension terminal is free to tilt on a rod fixed to the insulating tube and soldered to the conductor connecting with each terminal of the secondary windings. It is traversed by a freely-sliding micrometer rod, which

allows the test pressure to be limited by controlling the distance of the poles, and the secondary pressure to be determined by reference to a table giving the disruptive distances in air in terms of the voltage. By connecting the secondary windings in series or in parallel, the following working conditions are obtained in permanent operation :— First, 50 K.V.A., with 250,000 volts between the terminals, that is, 25 K.V.A. at 125,000 volts in each core (series connection), and second, 50 K.V.A. with 125,000 volts between terminals (parallel connection).

The transformer proper, instead of resting on the bottom of the tank, is suspended from the lid by four threaded rods fixed by nuts. This arrangement allows the secondary windings to be readily and rapidly inspected. All that is required in order to lift the transformer out of its housing is to raise the lid by its two suspension hooks, by means of a tackle fixed to the timberwork of the testing room.

There has been provided a fifth high-tension terminal connected up to the first two series coils of one of the secondary windings. This is intended both for checking directly the transformation ratio and for effecting certain scientific tests.

Tests made on delivery at the Charleroi Works have given as an average of a number of figures obtained on the whole of the secondary coils of each core, a transformation ratio very closely approximating $\frac{1}{1000}$.

The pressure regulator consists of a metallic rheostat inserted in the primary circuit (low tension). This regulating method was chosen, as the primary current was to be derived from two phases of an existing three-phase power and lighting plant. In order to allow a quite gradual scale of pressure to be obtained under load and with no load, the rheostat was made in two sections, each of which can be connected up gradually in series with each division of the other. The number of divisions of each section is such as to allow a scale of pressure between 0 and 250,000 volts to be obtained by their combination, in steps of 500 volts, at no load, as well as with full load.

In order to protect the operator controlling the primary circuit, as well as the three-phase line of the remaining installation against any excess pressure due to an accidental contact between the high and the low-tension windings, the following arrangement was adopted :—

The current at 250 volts, 40 cycles, is conveyed by an overhead line from the central station of the works to the laboratory. It is received at first on a switchboard panel through a two-pole switch and two porcelain-handle fuses. From the switch it goes through the regulator, after registering its amount in an ammeter,

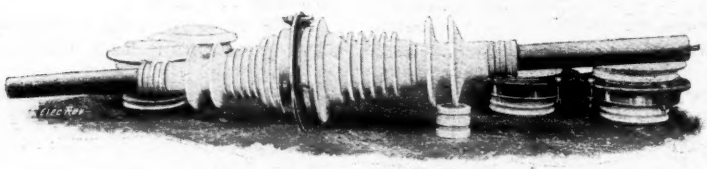


Fig. 3.—H.T. Terminal, 250,000-volt Transformer.

and feeds the primary of an auxiliary oil-bath transformer (with a ratio of transformation = 1), the primary and secondary windings of which are carefully insulated.

This arrangement allows one of the terminals of the primary windings of the high-tension transformer to be grounded. Between the other terminal and the ground is an excess voltage cut-out arranged immediately on the lid of this transformer.

This excess voltage cut-out consists of a system of alternate zinc and mica plates placed one above another. The thickness and number of these plates are such that as the pressure between the ground and the conductor reaches 350 volts, the zinc plates are short-circuited, thus short-circuiting at the same time the two terminals of the primary circuit of the main transformer. As the operator and the feeding line are separated from the circuit by an auxiliary transformer, they are safe against any danger.

The secondary of the auxiliary transformer (250/250 volts) is connected to the primary of the main transformer by a single-pole switch and a single-pole maximum current, zero-tension automatic cut-out.

In order to prevent any access to the testing troughs while under pressure, the laboratory has been subdivided into three

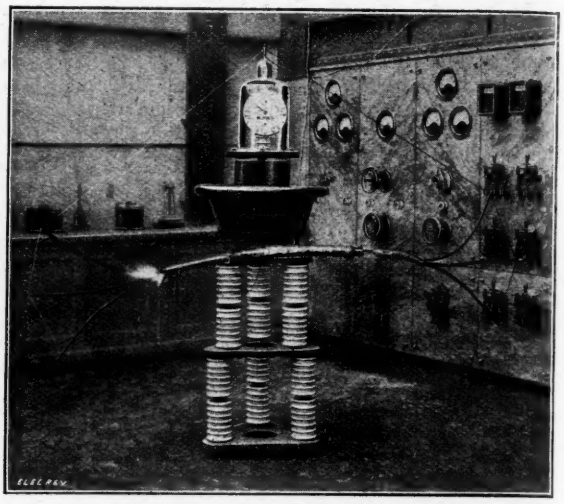


Fig. 4.—Cable-testing Laboratory: Puncture Test at 99,000 Volts.

compartments. Each of the two outer compartments contains a testing trough, the transformer being installed in the middle compartment, which is partly closed in front by a switchboard comprising three white marble panels. These compartments are closed by doors carrying switches connected up to the zero-tension coil of the cut-out above-mentioned. On opening one of these doors, the corresponding compartment being under pressure, the circuit of the coil is interrupted, which results in the switch being released and the bus-bars being made dead.

In order to allow any insulators to be removed after testing, and new insulators to be placed on one of the testing troughs while one set of insulators is being tested in the other trough, the high-tension bus-bars have been sectioned on both sides. As the operator only has two section switches at his disposal, he is compelled in order to place trough No. 2 under pressure, to withdraw the section switches from trough No. 1, thus insulating this completely from the transformer.

The testing voltage is generally measured by means of five voltmeters connected up to the primary, which are graduated directly for high tension, the ratio of transformation having been found accurately to be $\frac{1}{1000}$.

The scales of these voltmeters, which can be connected up successively to the circuit by means of a double-pole switch are as follows: 0-20,000, 10-50,000, 40-100,000, 60-150,000, 0-250,000 volts. This arrangement allows the testing voltage to be determined most accurately throughout the range of 0 to 250,000 volts.

Another testing laboratory installed by the Charleroi Co. at their own cable works comprises, in addition to instruments for measuring the resistance, capacity and insulation of cables, a set of apparatus allowing cables to be submitted to testing voltages considerably in excess of working voltages, as well as apparatus for research work on such insulating materials as are used in cable manufacture.

The energy required for these tests is supplied to the laboratory by underground conductors in the form of three-phase current at 50 cycles, 6,600 volts, which is transformed both for the requirements of the laboratory and for feeding the numerous motors actuating the machinery of the cable works, by means of two static oil-bath transformers with a transformation ratio of 6,600/230 volts.

The 6,600-volt current serves in its turn to actuate a motor-generator set consisting of an asynchronous motor of 125 H.P. at 6,600 volts coupled rigidly to an 80-K.V.A. single-phase alternator rotating at a speed of 960 R.P.M., and producing alternating current at pressures between 0 and 250 volts. This alternator is excited by an exciter machine mounted on its shaft, which produces continuous current at 110 volts. This exciting current is controlled by means of a specially constructed field rheostat, comprising a large number of resistance steps, so as to allow all intermediary pressures between 0 and 250 volts to be obtained at the terminals of the alternator. The field rheostat of the exciter allows this regulation to be completed.

The alternator is designed for supplying two static single-phase transformers. One of these is of similar construction to the one previously described, and gives 80 K.V.A. at its secondary terminals under pressures variable between 0 and 250,000 volts. By coupling the two parts of the high-tension winding in series or in parallel, an output of 80 K.V.A. can be obtained either at 0 to 125,000, or at 0 to 250,000 volts.

The other transformer is intended for testing work at lower pressures; its ratio of transformation is 250-25,000 volts; the two parts of the secondary winding may be connected up in series or in parallel, thus giving 25,000, or 12,500 volts. These two transformers have been tested at 350,000, and 40,000 volts respectively.

In fig. 4 the laboratory is shown during a cable-puncture test. The cable under test comprises three copper conductors 50 sq. mm. in cross-section insulated with impregnated paper, a homogeneous lead sleeve, and a double iron armature covered with asphalted threads. This cable, designed for working at 11,000 volts, was found to break down at 99,000 volts.

The cable works are equipped for manufacturing armoured cables, designed for working pressures of up to 150,000 volts.

The same cable works also contain a portable cable-testing station comprising the following parts:—A generating set consisting of a 45-H.P. gasoline motor and a single-phase alternator of 30 K.V.A. at 125 volts, 50 cycles, and 1,000 R.P.M., which is installed on a truck, and a transformer set consisting of single-phase transformer for 0 to 125 volts, 50 cycles, and capable of developing at its secondary terminals 30 K.V.A. at 20,000 or 40,000 volts, a set of six adjustable self-induction coils for compensating the capacity of the cables under test, and a switchboard carrying in addition to any measuring apparatus, the field rheostats of the alternator and the exciter. This second part of the installation is carried by another truck connected during tests with the former by removable couplings.

This portable station allows 5 km. of armoured cable with a copper section of 3 × 35 sq. mm. and a capacity of ·2 microfarad per km. to be tested at 30,000 volts, the testing voltage being ascertained by means of a portable electrostatic voltmeter of the Hartmann & Braun system.

A Telephone Time-Saver.—For the purpose of saving the time usually wasted in "holding the line" a "Telephone Time Saver" has been invented by Mr. H. Waymouth Prance, of Dudley House, Southampton Street, Strand, W.C. In brief, the device consists of a sound magnifying trumpet, of flattened form similar to certain types of motor horns, behind which is a platform adapted to support the telephone receiver. Upon receiving or making a call upon the telephone, and being asked to "hold the line a moment," the user, instead of "holding on" with the telephone receiver pressed to his ear, merely drops the receiver on to the platform of the "time saver," where it automatically slides into position with the earpiece against the small end of the spiral trumpet. The user is then free to go on with his work until the voice from the trumpet shows him that the person at the other end is speaking. Conversation can then either be carried on using the loud-speaking trumpet—thus affording the advantage of leaving the user's hands both free for the purpose of turning up references, taking down a message from dictation, &c., or the receiver may be lifted off the instrument and used in the ordinary way. It is possible for the user of one of these instruments to move some little way from the telephone and yet hear when the person at the other end is speaking.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Municipalities and Contractors at Cape Town.

There seems to have been a fair amount of discussion lately relative to the friction between municipalities and contractors. I enclose you a letter addressed to the local contractors here from Mr. Long, the city electrical engineer.

Some time ago the Council obtained the consent of the ratepayers to put in three points free to any future applicants for electric light, and the Council, in due course, advertised for tenders, and received them as per Mr. Long's letter. The successful firm did not complete the work quickly, so the arrangement has now been come to that any of the local contractors will accept any work offered to them by the Council at 22s. 6d. per point for plain flex pendant, 16-50-C.P. metal-filament lamps and opal shade, minimum three points, the work to be equally distributed.

Any contractor can, therefore, canvass for work; the price is fixed beforehand, and the contractor is free from bad debts. The consumer has to sign the agreement with the Council, and has to get the consent of the landlord as well. The arrangement works splendidly; the installation may consist of any number of points.

The consumer may use as much current as he likes up to 3·33 units per point, *i.e.*, $\frac{2s.\ 6d.}{9d.}$ = the total amount of revenue received per point per month divided by the rate, which is 9d. per unit.

Say a consumer has 10 lights; he can use 33 units a month for 12 months. From his point of view, he pays 9d. a unit, and if he uses his full quantity, he has paid his 25s. per month (2s. 6d. per point) for current used. There is no limitations as to how he shall consume his units; he can put in radiators if he likes, but he must pay 9d. a unit for all over 3·3 units. It is, however, most unlikely that a consumer with 10 lights will exceed, say, 10 or 12 units a month.

From the Council's point of view, they pay the contractor, for 10 points, £11 5s., and draw as revenue £15 (2s. 6d. per point per month for 12 months), which leaves a balance of £3 15s. for current.

Taking the worst case of a consumer who uses 396 units per annum: $\frac{£3\ 15s.}{396}$ = about 2¼d. per unit, which is quite a fair return to the Council for these extra units supplied. Interest does not count. On the other hand, suppose a consumer says he will pay cash for his installation = £11 5s., he then pays a minimum of 5s. per month for current, and gets only 7 units for his whole installation, and saves only 15s. during the year. (*All* consumers pay a minimum of 5s. per month.) So it is very much to his benefit to pay monthly. It practically amounts to the Council giving all new consumers current at a little more than cost for the first year, as an inducement to take electricity.

I thought this might be of interest to the general body of electricity suppliers and users as being a very satisfactory solution to a difficult problem.

Your Correspondent at the Cape.

July 23rd, 1912.

[COPY.]

CORPORATION OF THE CITY OF CAPE TOWN.

Electrical Department,
City Electrical Engineer's Department,
Dock Road, Cape Town.
July 20th, 1912.

Messrs. X Y Z.

Re FREE WIRING.

Dear Sirs,—I beg to acknowledge the receipt of a letter dated the 19th inst., signed by yourself and several local electrical contractors, regarding the price per point to be paid for work done, under the Corporation system of free wiring.

My offer of £1 1s. per point was founded on the tenders that were received recently for this class of work, the lowest of which was £1, and the next £1 0s. 10d.

In view of your remarks regarding the rise in prices, I am prepared to accept your terms, namely, £1 2s. 6d. each for all

plain flexible points with plain opal shade. The question of the price for a rise and fall, fancy fittings, &c., need not be discussed here, as it is a matter entirely between the contractor and consumer.

All switches to be placed as indicated by the consumer, provided such positions are reasonable.

All fancy shades, spider or ornamental fittings, outside fittings, higher candle-power that 16-50 metal-filament lamps required, to be paid for direct by the consumer to the contractor. The same also applies to wiring carried out other than on the surface, with the exception of wiring placed above the ceiling of single-storey houses, and the top floor of houses other than single storey.

In this connection, I might mention that as the consumer is more or less given into the hands of the contractor, it is expected that extras will be carried out at a reasonable remuneration.

I have to inform you that the present free wiring is being extended to any number of points, provided the consumer agrees to pay 2s. 6d. per point per month for the first year. The minimum charge for current per month to be 7s. 6d. as at present. Of course it must be thoroughly understood that all proposed installations must be approved of by myself or representative, and that I may refuse payment should the work be completed before such is obtained, or on finding the applicant not a desirable consumer.

The contractor must guarantee to maintain the installation and to execute all repairs due to bad materials or workmanship for 12 months from the date of connection. Otherwise this work will be carried out at the contractor's expense, and the amount deducted from any sums due to such contractor in the Council's possession.

If the above terms be accepted, full payment for the installation will be made in due course, according to the Council's regulations, after the work is passed and the connection made.—Yours faithfully,

(Signed) Walter F. Long,
City Electrical Engineer

The Bray Explosion.

As the finding on the above explosion is inconclusive, perhaps those engineers who have had similar trouble (though in a lesser degree) will state their experiences and help to arrive at a true conclusion.

In my own case, I have experienced both explosions though not simultaneously.

The fuel valve explosion occurred on a two-cylinder engine. Before turning on the starting air the attendant has to make sure that fuel oil is reaching the fuel valve on the cylinder cover. The main oil valve is turned on and when a good flow of oil is observed coming out of the test cocks, these latter are closed and the engine started up without delay. If there is a slight delay, it is advisable to close the main oil valve until ready.

One day the attendant did not close the main valve, and delayed starting up for over five minutes, consequently an excess of fuel oil accumulated in the combustion casting containing the fuel valve, and when the air starting lever was thrown up into running position, an explosion occurred in the fuel valve, blowing the top off the combustion casting cap and the fuel needle valve through the roof. The trouble did not go further.

The other explosion was on a four-cylinder engine, which had already been running satisfactorily nine hours. During the last two hours the load increased, and the air blast was raised to 820 lb. from 710 lb., as required, and had been at the higher pressure some little time when the copper delivery pipe, from the H.P. air pump to the blast receiver, commenced reeking (due to the presence of oil on an overheated pipe), close to the air pump, and immediately afterwards an explosion occurred at the top of the blast receiver vessel, which blew the safety valve, with which these vessels are fitted, across the engine room, and burst off the copper delivery pipe (*i.e.*, the pipe conveying air from the blast receiver to the fuel valve) at its connection with the receiver, bending the pipe up into the air and twisting it into two neat coils at the end. No other damage was done. The pipe was straightened out and reconnected after a new nozzle had been brazed on, the safety valve hole plugged temporarily, and the engine restarted, finishing the day's run satisfactorily in parallel with a second engine.

In the first case, the fuel valve explosion was undoubtedly caused by an excess of fuel oil at that particular place; the combustion became excessive and was carried into the fuel valve before it closed.

In the second case, I am strongly of opinion the trouble arose through the valves of the H.P. air-pump allowing the pump pressure to be overcome by the pressure of combustion in the main cylinders. The blast receiver, though undamaged, was extremely hot after the event. Later a faulty valve spring was found in the pump.

In neither of these cases was there an excess of oxygen.

What I wish to point out is that an explosion can occur at the fuel valve due to an excess of fuel oil there, also if the cylinder pressure overcomes the air-pump it will show itself in or about the blast receiver.

I am not convinced as yet that "the root cause of the trouble was undoubtedly the oxygen," as you suggest, though it certainly could have been, but I am of opinion that the *severity* was due to its presence, also that "a plug of oil was driven into the blast vessel and ignited by the following flame."

Perhaps Mr. McDonnell will kindly state what caused the starting air to be lost in the first instance? Was the fuel valve examined for correct adjustment and tension between this stoppage and the restart with oxygen? And how many (about) revolutions had the crankshaft made before the explosion occurred?

E. A. Wood.

Tramways Department,
Castleford, York,
August 13th, 1912.

INTERNATIONAL ELECTROTECHNICAL COMMISSION.

The following is the second instalment of definitions of electrical terms adopted by the British Electrotechnical Committee to assist the work of the Commission. The first instalment appeared in our issue of August 7th, 1908, p. 237.

Sub-Committee on Nomenclature:—Mr. A. P. Trotter (Chairman); Messrs. S. Z. De Ferranti, W. Duddell, F.R.S., Robert Hammond, R. W. Hammond, H. W. Miller, F. H. Nalder, Dr. A. Russell, A. Siemens, Dr. S. P. Thompson, F.R.S., C. H. Wordingham, and P. F. Rowell (Secretary).

Note.—Words printed in Small Capitals are already explained or will be explained later.

Supplementary Terms (A to E).

Absolute.—A system of magnitudes is said to be absolute when all the magnitudes of the system can be defined in terms of units adopted as fundamental. An instrument for absolute measurements is one which can be standardised by means of measurements which involve only the fundamental units.

Admittance.—The reciprocal impedance. The quotient obtained by dividing the current in a conductor by the electromotive force which produces it.

Alternation.—A term not recommended. A half period. See Period and Frequency.

Antenna.—A conductor or system of conductors for the emission or reception of Hertzian waves.

Balancer.—A motor-generator or accumulator used to equalise differences of potential between the different wires of a multiple-wire system.

Ballistic.—An instrument in which the period of the moving part is long compared with the time of the duration of the transient force which the instrument is intended to measure.

Bifilar Suspension.—The suspension of the moving part of an instrument by two threads, so arranged that the restoring force is mainly produced by gravity.

Bow.—A bow-shaped appliance for effecting a sliding connection between an overhead conductor and an electrically-propelled vehicle.

Carcel.—The name of a standard oil lamp, the official standard of candle-power used in France.

Characteristic.—A curve or graph representing the relations between two magnitudes, which characterise the behaviour of an apparatus; *e.g.*, the exciting current of a dynamo and the electromotive force generated.

Charge.—(*a*) Of a conductor. The total quantity of electricity on it.
(*b*) Of an accumulator. See Accumulator.
(*c*) Of a condenser. See Condenser.
Verb to charge. The operation by which any apparatus receives a quantity of electricity, part or the whole of which it returns on discharge.

Coercive Force.—The magnetic force required to annul the residual magnetism of a substance.

Coil.—One or more turns of a conductor wound side by side in one or more layers.

Condenser.—An apparatus consisting of two conducting surfaces separated by a dielectric.

Conductance.—The conductance of a conductor is the quotient of the current by the potential difference between the terminals of the conductor, usually expressed in Mhos.

Conductivity.—The conductivity (specific conductance) of a substance is measured by the current which flows parallel to an edge through a unit cube of the substance, when unit difference of potential is maintained between the two faces perpendicular to that edge. The reciprocal is Resistivity.

Conductor.—A body or substance which permits the passage of electricity.

Counter Electromotive Force or Back-Electromotive Force.—An electromotive force which opposes the flow of the current in the circuit.

Decohere.—To restore a coherer to its original state of resistance.

Delta.—A mode of connection in three-phase alternating-current working, in which three windings or apparatus are so connected that they may be diagrammatically represented by a triangle. A particular form of mesh.

Diamagnetic.—A substance having a magnetic permeability less than that of a vacuum (unity).

Direct Current.—A term not recommended. See Continuous Current.

Discharge.—(*a*) Of a condenser. An operation which tends to bring the two conducting surfaces of a condenser to the same potential.

(*b*) Of an Accumulator. An operation which tends to bring the two plates of an accumulator to the same potential, and which permits the chemical energy to be reconverted into electrical energy, and utilised in an outside circuit.

Disruptive Discharge.—The breaking down of a dielectric under electrical stress, accompanied by sparking.

Eddy Current.—A current induced in a conducting body either by a varying magnetic field or by the body moving relatively to a fixed magnetic field.

Efficiency.—(1) In case of generators, motors, converters or transformers: The ratio of the total output to the total input. (For instance: In case of a separately excited synchronous generator the excitation power should be added to the power received at the shaft).

(2) In case of Accumulators:

(*a*) The ratio of the amount of energy available during the discharge to the amount of energy required during the charge (watt-hours).

(*b*) The ratio of the amount of current available during the discharge to the amount of current required during the charge (ampere-hours).

Electrometer.—An instrument which utilises electrostatic forces for the measurement or comparison of differences of potential.

Extra Current.—An obsolete term. The current during the variable period on closing or opening an inductive circuit.

Extra High Pressure.—See Pressure.

Factor of Safety.—In mechanics, the ratio of the ultimate breaking stress to the maximum normal working stress.

Farad.—In the practical system of units the farad is the unit of electrical capacity. It is inconveniently large, and therefore capacities are usually expressed in microfarads.

Fault.—Any local defect in the insulation or continuity of a conductor which may interfere with its use.

Feeder.—A conductor for conveying electrical energy from the place where generated or transformed to feeding-points or sub-stations. Feeders are not used for supplying consumers directly, owing to the varying pressure along their length.

Feeder Box or Pillar.—A box or pillar which may contain switches, links or fuses for connecting feeders with distributing networks.

Feeder, Negative.—See Return Feeder.

Feeding Point.—The junction of a feeder with the network.

Ferro-Magnetic.—A substance whose permeability is greater than that of a vacuum (unity). See Paramagnetic.

Field, Electromagnetic.—See Field, Magnetic.

Field, Electrostatic.—Any region in which there are electric lines of force, as in the space between a positively charged and a negatively charged surface.

Field Magnet.—Any permanent magnet or electromagnet employed for the purpose of providing a magnetic field. (It is incorrect to speak of the field magnets of a dynamo or motor as its fields; they should be called its magnets, if the term field magnets is too long.)

Field, Magnetic.—Any region in which there are magnetic lines of force, as in the space between or surrounding the poles of a magnet or within a magnetising coil. The strength of the field is usually expressed in C.G.S. measure as the number of lines per square centimetre. One line per square centimetre is called a Gauss. See Line and Maxwell.

Figure of Merit, of a Galvanometer.—(*a*) The deflection in millimetres per micro-ampere at a scale distance of one metre when reduced to a period of 10 seconds and a resistance of one ohm.

(*b*) The current in amperes required to produce a deflexion of one millimetre at a scale distance of one metre. Sometimes expressed as the number of megohms through which one volt will give that deflection.

Of a telegraph instrument. The minimum current necessary to work the instrument with absolute certainty.

Flame Arc.—An arc in which the major portion of the light is given by the flame instead of by the electrodes.

Flashing.—(*a*) Any process of manufacture involving the temporary electrical overheating of a glow lamp filament.

(*b*) The coating of a glow lamp filament with a layer of carbon by heating it electrically in a hydro-carbon vapour.

Flashing Over.—The temporary formation of an arc from brush to brush on a commutator.

Flash Test.—The momentary application of a high electrical pressure between two conductors insulated from each other.

Flux.—(*a*) Magnetic. The number of lines of magnetic induction which pass round a magnetic circuit. See Induction.

(*b*) Photometric. The whole luminous radiation of a beam of light, or the candle-power multiplied by the solid angle of the beam.

(*c*) Chemical. Material used for reducing or dissolving the oxides of molten metals in casting, soldering, brazing, &c.

Foot Candle.—The illumination produced by a source of one candle-power falling perpendicularly on a surface at a distance of one foot from the source.

Form-Factor.—The ratio of the effective value to the mean value of a periodic function.

Fourth Rail.—See Conductor Rail.

Friction Loss.—Loss due to mechanical friction exclusive of windage.

Frog.—In tramway overhead work. A fitting uniting two diverging trolley wires with a single wire (*a*) provided with a spring tongue, or (*b*) of the fixed type.

Fuse.—The actual wire or strip of metal in a cut-out which is fused by an excessive current.

Galvanometer.—An instrument for measuring small electric currents.

Gap, Air-, Magnetic.—Any air space in a magnetic circuit.

Gap, Spark.—Any break in the continuity of a metallic conductor so arranged as to permit of an electrical discharge across the break.

Gauge.—(*a*) A general term applied to various kinds of measuring instruments.

(*b*) The thickness of a plate, or the diameter of a wire, on the inch, millimetre, or on any arbitrary scale.

(*c*) The distance between the rails of a railway or of a tramway. In the case of a railway it is the distance between the inner sides of the heads of the rails. In the case of a tramway it is the distance between the inside edges of the tread of the rails, *i.e.*, over and including the grooves.

Gauss.—A name given to the absolute electromagnetic unit of magnetic induction in the C.G.S. system. See Field, Magnetic, and Line.

Generating Set.—The combination of a generator and a prime-mover.

Glow Discharge.—A silent discharge of electricity through a gas which causes the gas to have a uniformly luminous appearance or glow, and which does not volatilise the electrodes.

Glow Lamp.—A lamp in which the filament or wire is caused by the current to glow or incandesce. A term recommended instead of incandescent lamp in order to avoid confusion with the incandescent gas mantle.

Gramme Calorie. See Calorie.

Great Calorie. See Calorie.

Grid.—In an accumulator. The framework supporting the active material.

Ground.—A term used in America having the same meaning as earth.

Henry.—The practical unit of the coefficient of self-induction or of mutual induction in the electromagnetic system.

High Pressure.—See Pressure.

High Tension.—Obsolete term for high pressure.

Homopolar, Dynamo or Motor.—A dynamo or motor in which the inductive action takes place in a magnetic field or a series of magnetic fields without change of sign.

Homopolar Induction.—A term sometimes applied to the induction which occurs when a conductor is moved through a magnetic field, so as to cut the lines of force in the same direction continuously. Sometimes called unipolar.

Horse-Power.—The industrial unit of power. The British horse-power is equivalent to 33,000 foot-pounds per minute or (approximately) 746 watts.

Hot Wire Instrument.—An instrument the indication of which depends on the expansion of a wire or wires through which flows an electric current.

Hysteresis.—The lagging of the strain behind the stress, which when the material is taken round a complete cycle and brought back to the initial state, involves a dissipation of energy.

Hysteresis, Magnetic.—The tendency by which changes of magnetism lag behind the changes of magnetic force which cause them.

Impedance.—The ratio of the electromotive force to the current which is produced by it in a conductor. The term is used with varying or alternating currents.

Incandescent Lamp.—See Glow Lamp.

I.H.P.—Abbreviation for indicated horse-power.

Inductance.—(*a*) Synonym for coefficient of self-induction.

(*b*) The reactance due to self-induction. See Reactance.

Induction.—When an electric or a magnetic force acts, through the ether, upon a body so as to alter its electric or magnetic state, that alteration of state is said to be induced in it, as distinguished from alterations of state communicated to it by conduction or contact. The operation of inducing alteration of state is called induction. The three chief induced actions are (*a*) induced electrostatic charge; (*b*) induced magnetism; (*c*) induced electromotive force.

Induction, Electrostatic.—When a body is brought into an electric field, thereby causing an electric charge or charges to appear on the body, these charges are called induced charges; and the operation is called electrostatic induction.

Induction, Magnetic.—When a mass of iron, &c., is brought into a magnetic field, thereby causing magnetic poles to appear on the mass, these poles are called induced poles, and the magnetism so acquired is called induced magnetism; and the operation is termed magnetic induction. (The magnetic lines of force so imparted to the mass of iron, &c., are called magnetic lines of induction.)

Induction, Magneto-Electric.—When a body is subjected to the action of a varying magnetic field, thereby causing electromotive force to be generated in the body, these electromotive forces are called induced electromotive forces; and any currents that result in the body are called induced currents; and the operation of thus inducing electromotive forces and currents is called magneto-electric induction.

Induction Motor.—An alternating-current motor in which the secondary part receives its current by magneto-electric induction and not by conduction.

Induction, Mutual.—The (magneto-electric) induction exercised between two circuits, whereby the variations of the current in one circuit generate electromotive forces in the other circuit is called Mutual Induction. This mutual relation may be quantitatively expressed by means of a Coefficient of Mutual Induction.

Induction, Mutual, the Coefficient of. (M) is the sum of the effective linkages of the turns of one circuit (the secondary) with the flux due to unit current in the other circuit (the primary).

Induction, Self.—The (magneto-electric) induction exercised upon the turns of a circuit by the current in itself is called Self-Induction. It may be quantitatively expressed by means of a coefficient of self-induction.

Induction, Self, the Coefficient of. (L) is the sum of the linkages of flux and current when the current in the coil is unity. The (total) self-induction of any coil is the product of its coefficient of self-induction and the current it is carrying.

Induction, Unipolar.—See Homopolar.

Inductive Capacity, Specific.—See Capacity.

Inductive Circuit.—A circuit in which the self-induction at the working frequency or at make or break is appreciable compared with its resistance.

Inductive Load.—An output at a power factor which by reason of self-induction is less than unity.

Inductive Resistance.—A resistance having appreciable self-induction.

Inductor Generator.—A generator with stationary field and stationary armature coils and in which masses of iron or inductors by moving past the coils alter the magnetic flux through them.

Inductors.—In inductor generators. The masses of iron employed to effect variations of the magnetic flux passing through the armature coils.

Input.—The total power received at the shaft or terminals of a machine or apparatus.

Insulate (v.a.).—To surround or support a conductor by non-conducting bodies or materials so as to restrict the flow of electricity to the desired path.

Insulator.—(*a*) Any material which does not appreciably conduct electricity.

(*b*) An appliance used to insulate and usually to support a conductor.

Integrating Meter.—A meter which sums up or integrates the quantity to be measured, with reference to time.

Intermediate.—The intermediate or neutral or middle wire or wires of a three-wire or multiple-wire system.

Intensity.—There is an increasing disposition to restrict the use of the word intensity in English physical science to a ratio, the denominator being an area. The older meaning was synonymous with strength.

Intensity of Current.—An obsolete expression. It has been replaced by strength of current.

Intensity of Field, Magnetic.—See Magnetic Field.

Intensity of Light.—The illuminating power or candle-power of a source of light.

Intensity of Magnetisation.—The magnetic moment per centimetre.

Interrupter.—Sometimes called break. A mechanism or device used to break the primary circuit of an induction coil.

Ion.—An ion is a charged atom or molecule, or a group of atoms or molecules carrying a charge.

Joule.—A unit of heat equivalent to 0·24 = calorie, or one watt-second.

Joule Effect.—The heating in a conductor by the passage of an electric current through it, and due to the resistance of the conductor.

Kathion.—The ion which is carried to the kathode.

Kathode.—(*a*) In an electrolytic cell. The conductor through the surface of which the current leaves the electrolyte.

(*b*) In a primary cell. The conductor (generally carbon) through which the current leaves the electrolyte.

(*c*) The electrode by which the current leaves a cell or other apparatus, such as a vacuum tube.

Keeper, of Magnet.—An iron bar for completing the magnetic circuit (usually of a permanent magnet). See Armature.

Kelvin.—A term officially proposed and authorised by the Board of Trade, May, 1892, but which has not come into common use, for a kilowatt-hour.

Key.—An appliance consisting essentially of a lever carrying a contact or contacts, generally used in signalling and in testing.

Kicking Coil.—Name given to a choking coil used in conjunction with lightning arresters.

Kilowatt.—A unit of power. One thousand watts. Equivalent to 1·34 British horse-power (approximately).

K.V.A.—Contraction for kilo-volt-ampere, or one thousand volt-amperes.

KW.—Contraction for kilo-watt.

Lag.—The interval of time or angle by which one event follows another. See Phase Difference.

Lagging Current.—An alternating current the phase of which is retarded in time relatively to the impressed electromotive force.

Lamination.—The division of a mass of material into thin sheets either to prevent eddy currents or to give flexibility. The thin sheets or stampings of iron forming part of a magnetic circuit are often called the laminations.

Lay, in a Cable.—The pitch or length parallel to the axis of one complete turn in the spiral arrangement of a stranded cable may be expressed (*a*) as a multiple of the diameter of the layer considered; or (*b*) as the increase in length of a strand above the length of the cable, expressed as a percentage of the length.

Lead.—(*a*) Of a conductor or pipe. Its direction or run.

(*b*) Sometimes used as a synonym for a conductor.

(*c*) Of an alternating quantity. The interval of time or angle by which one event precedes another. See Phase Difference.

Leading Current.—An alternating current the phase of which is in advance in time relatively to the impressed electromotive force.

Leakage.—(*a*) The passage of electricity from one conductor to another or to earth, caused by want of perfect insulation.

(*b*) Magnetic. That part of the magnetic flux which does not follow the path provided for it.

Leakance.—The reciprocal of insulation resistance.

Leyden Jar.—A condenser in the form of a jar, generally of glass, having a conducting surface inside and out.

Lightning Arrester.—An appliance for protecting electrical apparatus by providing an alternative discharge path.

Limiter.—A device for giving warning when a predetermined current is exceeded.

Line, Telegraphic.—That part of a telegraph, telephone or railway signalling circuit, whether aerial, underground or submarine, which does not include the controlling or operating apparatus and the source of power. Used also, collectively, for a group of wires including poles, pipes, junction boxes, &c.

Lines of Force.—(1) A line such that the tangent to it at any point represents the direction of the force acting at that point.

(2) **Magnetic.**—A line such that the tangent to it at any point represents the direction of the magnetic force at that point.

By convention the magnitude of the magnetic force at any point is represented by supposing as many magnetic lines of force to be drawn through one square centimetre (situated around the point) as there would be dynes exerted on unit pole if placed at that point. Unit intensity, *i.e.*, one dyne per unit pole, or one line per square centimetre is called one **Gauss.** See Magnetic Flux.

(3) **Electrostatic.**—A line such that the tangent to it at any point represents the direction of the electric force at that point.

By convention the magnitude of the electric force at any point is represented by supposing as many electrostatic lines of force to be drawn through one square centimetre (situated around the point) as there would be dynes exerted on one unit of positive electricity placed at that point.

Link.—A readily removable conductor forming part of a circuit, generally in the form of a flat bar.

Linked Switches.—Switches linked together mechanically so as to operate simultaneously.

Load.—(*a*) Synonym for output.

(*b*) Synonym for weight.

Loaded. Telegraph Line or Cable.—A line or cable of which the self-induction has been intentionally increased.

Load Factor.—The number obtained by dividing the actual output of a generator or of a whole generating station during a given period by the output if the maximum had been maintained during that period.

Loop Test.—A method of testing employed to locate a fault in a telegraph or other conductor when it can be arranged to form part of a closed circuit.

Looping In.—Bringing a wire as a loop to and from a terminal to avoid making a T-joint.

Loss, Total.—The difference between output and input.

Low Tension.—Obsolete term for low voltage.

Magnet Coil. Magnetising Coil.—The winding used to magnetise an electromagnet, such as the field magnet of a dynamo, sometimes called field coil.

Magnet, Permanent.—A body which, having been magnetised, retains its magnetisation.

Magnet, Winding.—A set of magnet coils.

Magnetic Blowout.—An apparatus so arranged as to produce a magnetic field which breaks the arc formed on opening the circuit.

Magnetic Flux.—The number of magnetic lines which pass through any area is called the flux through that area. In the case of a closed magnetic circuit, the number obtained by multiplying magneto-motive force by reluctance. Unit, one line or Maxwell.

Magnetic Flux Density.—The number of magnetic lines per square centimetre. The number obtained by dividing magnetic force by permeability. Sometimes called the induction, a term not recommended in this sense.

Magnetic Force.—The force at any point in a magnetic field experienced by a unit pole placed at that point, sometimes called field intensity or strength of field. (At any point in a closed magnetic circuit, the magneto-motive force at that point.) (In a closed magnetic circuit, the magneto-motive force per unit length.)

Magnetic Permeability.—Magnetic conductivity or specific permeance compared with vacuum. The number obtained by dividing magnetic flux density in a substance by magnetic force.

Magnetic Permeance.—Sometimes called magnetic conductance. The number obtained by dividing magnetic flux by magneto-motive force.

Magnetic Reluctance.—The reciprocal of magnetic permeance (sometimes called magnetic resistance, a term not recommended).

Magnetic Reluctivity.—Specific magnetic reluctance. The reciprocal of permeability of a substance.

Magnetic Remanence.—Residual flux density after the magnetic force has been removed.

Magnetic Susceptibility, or Magnetisability.—The number obtained by dividing magnetic intensity by magnetic force.

Magnetisability.—See Magnetic Susceptibility.

Magnetisation.—(1) The process or the result of communicating magnetism to a body.

(2) The (intensity of the) magnetic moment per unit of volume of a magnet.

Magnetise.—To give a body the properties of a magnet.

Magneto.—Contraction for magneto-electric generator. A generator whose field magnets are permanent magnets.

Magnetometer.—An instrument for measuring magnetic force.

Magnetomotive Force.—That which causes or tends to cause a magnetic flx. The unit is $4\pi / 10 \times$ ampere-turns. The industrial unit is the ampere-turn.

Main.—Any conductor forming part of a distributing network. The principal conductors are collectively called the mains. (See Feeder and Trunk Main.)

Maxwell.—The name given to the magnetic line of force or unit of magnetic flux.

Mesh.—A mode of connection in polyphase alternating current working, in which the windings or apparatus are so connected that they may be diagrammatically represented by a closed figure.

(To be continued.)

PROCEEDINGS OF INSTITUTIONS.

The Association of Consulting Engineers.

The first meeting of duly elected members of this Association was held at the Institution of Electrical Engineers on Monday, July 22nd, Mr. G. Midgley Taylor, M.Inst.C.E., presiding.

The hon. secretary, Mr. A. H. Dykes read the list to date, 80 in all, explaining that some had only joined conditionally on their being satisfied with the rules in their final form.

The Chairman then said the business of the present meeting was to receive the rules presented at the meeting held in January and the report and proposals of the Provisional Committee, and to elect the first Committee of the Association. The Committee had, after consultation with their legal advisers, adopted the following definition:—

"A consulting engineer is a person possessing the necessary qualifications to practise in one or more of the various branches of engineering who devotes himself to advising the public on engineering matters or to the designing and supervising the construction of engineering works and for such purpose occupies his own office and employs his own staff, and is not directly or indirectly concerned or interested in commercial or manufacturing interests such as would tend to influence his exercise of independent professional judgment in the matters upon which he advises."

The Committee thought that probably not 5 per cent. of the members of the Institutions of Civil, Electrical and Mechanical Engineers complied with the definition of a consulting engineer that the Committee had already laid down, and that there had, up till now, been no source from which any one could obtain definite information as to who was an independent consulting engineer and who was not. The Association, subject to the rules being amended, would be composed of those members of the three Institutions on whom the rules of professional conduct drawn up by the Institution of Civil Engineers, and since accepted by the Institution of Electrical Engineers, were always binding, as distinguished from those members who were only bound by them when acting in a consultative capacity. The Association did not suggest that any duly-qualified engineer should not be consulted on any engineering matter on which he was an expert; but they did say that it should be possible to distinguish the independent consulting engineer from the expert who might be closely identified with manufacturing or contracting interests. The objects of the Association were set out in the Articles of Association, and they were, briefly, to uphold the standard of professional conduct and to promote the professional interests, rights, powers and privileges of consulting engineers. The Articles of Association and the rules, as proposed by the Committee, were in the members' hands, including the alterations of the original rules, which the Committee now asked the members to approve, and which were as follows:—

1. That the subscription be raised from one guinea to two guineas.

2. That corporate membership of the Institution of Civil Engineers or full membership of the Institutions of Electrical or Mechanical Engineers be accepted as evidence of technical qualifications for membership of the Association.

3. That members be entitled and requested to use the abbreviation M.Cons.E. when stating their qualifications.

4. That the Committee be increased to 18, of whom not more than 12 shall be London members.

After the rules had been finally approved by the meeting, the earliest opportunity would be taken to submit the memorandum and articles of association for the approval of the Board of Trade, and to register the Association, after which the final rules and list of members would be printed and circulated amongst the members, and Government Departments and engineering and public bodies would be notified of the formation of the Association. It was felt that the Association, as the only body representing consulting engineers, would form a useful channel through which the opinions of consulting engineers could be ascertained and with which bodies representing other engineering interests could usefully confer.

The meeting approved the alterations and the addition (with regard to the use of the abbreviation "M.Cons.E.") set out above.

The Chairman then moved, and Mr. W. R. Cooper seconded, a resolution that the memorandum and articles of association and the rules as amended and as printed in the document before the meeting, be received and adopted, which was duly carried.

Mr. J. H. Blizzard proposed that the members suggested by the Committee (Messrs. J. S. Alford, H. P. Boulnois, W. T. Douglass, B. Latham, E. L. Mansergh, W. M. Mordey, W. H. Patchell, H. Rofe, J. F. C. Snell, E. H. Stevenson, J. Swinburne and G. M. Taylor) be the London members of the Committee for this year. Mr. A. A. Campbell Swinton seconded, and the motion was duly carried.

The Chairman then proposed that the list of country members of the Committee be left vacant for the present, on the understanding that the Committee would fill the list up with the best names they could find for the provincial towns, and the motion was duly carried.

Wire Ropes for Lifting Appliances.

By Daniel Adamson, of Hyde.

(Abstract of paper read before the Institution of Mechanical Engineers, *at Belfast, July*, 1912.)

The question of the durability of the parts of mechanical structures seems to be strangely neglected by all authorities. A designer has generally the choice of several formulæ for calculating the mere strength of a given member, but usually he has to depend upon his own experience for the correctness of the proportions that will ensure for it a reasonable length of life. The durability of wire ropes in particular is of great importance to all engineers.

The wire used for lifting ropes is of crucible steel having a tensile strength varying from 80 to 130 tons per sq. in. Although ropes made from material having a high tensile strength are of smaller diameter for a given load and a given factor of safety, yet this is not a great advantage to the crane designer, because the stiffer character of the wires makes larger drums desirable, if the durability of the rope is to be considered.

The ratio of the diameter of the individual wires to the diameter of the completed rope is an important factor. If the wires are too large they are stressed considerably when passing over the pulleys, and accordingly the material is quickly fatigued and the wires break. Smaller wires, on the other hand, are more quickly worn through by rubbing against the pulleys and against their neighbours in the body of the rope.

Abrasion is the principal factor limiting the life of wire ropes, and taking two ropes of equal strength, of which one has four times as many wires as the other, it may reasonably be expected that with a pulley-diameter bearing the same proportion to the diameter of the wires, the life of the rope with fine wires will be one-quarter of that of the rope of coarser wires working over a pulley of correspondingly increased diameter.

A German investigator (Ernst Heckel) refers to the very great surface pressures on the wires at the place of contact with the pulley (amounting in his opinion to as much as 12 tons per sq. in.) as a vital point in connection with the wear of wire ropes. This high pressure, accompanied as must be the case by relative movement even if quite small, readily accounts for the wear which takes place on the surface of the wires where they touch the pulleys or the other wires in the rope.

The author has felt for many years past the want of information as to the effect of using pulleys of different diameters; the

experience of users afforded no reliable guidance, presumably on account of the great difference in the conditions under which ropes work in different shops. Inquiries addressed to the users of cranes elicited very various replies; ropes working upon cranes of the same general design were found to last for periods of from two years to ten years and upwards, and one correspondent suggested that 20 years might be expected from ropes on cranes (of from 5 to 20 tons capacity) if damage from accidental causes could be eliminated.

The most reliable and consistent information that the author has been able to discover is contained in a paper by Mr. A. S. Biggart published in 1890.

The effect of oiling the ropes is shown to be very beneficial, increasing the life of a given rope by two or three times. This is obviously due to the reduction of the cutting action of the wires upon each other. Experiments were also made to ascertain the effect on the life of a rope of running it over pulleys so arranged that the rope was subjected to reverse stresses. The results obtained from this series of experiments showed that generally the life of a rope working under such conditions was only one-half as long as that of a similar rope bent in one direction only.

When the first wire breaks, the rope may be assumed to have passed through one-half of its life, and as no one knowingly works a rope until it breaks entirely, the breakage of even a few wires is a sign that a rope should be carefully watched, and replaced by a new one at an early opportunity.

The effect of varying the proportions of diameter of pulley to diameter of rope is one of the most important features to be noticed. Speaking generally, Mr. Biggart's experiments show that increasing the diameter of the pulleys by an amount equal to two circumferences of the rope will double the life of the rope.

Whether two, four, or six falls are adopted, the diameter of the drum and pulleys should remain about the same, if the ropes are to have equal durability.

The ropes make two bends at the lower pulleys to one at the drum, and, therefore, if the lower pulleys are made of the same diameter as the drum, they will be responsible for two-thirds of the wear and tear of the rope. Now it is usually difficult to increase the diameter of the working barrel or drum of a crane, but a simple means of improving the durability of crane ropes is at the disposal of the designer, namely, to increase the diameter of the pulleys in the blocks, leaving the drums of the original size. This alteration can usually be effected without serious alteration of the design, and may even be carried out on existing cranes.

The result of increasing the diameter of the pulleys by an amount equal to two circumferences of the rope, will be that the effect of the double bend round the lower pulley is halved, and the resultant effect of the three bends will be equal to two only, and the relative life of the rope will be increased by 50 per cent.

Where, as is usually the case, the average height of lift in a shop does not reach half the maximum available, then that portion of the rope which passes under the lower pulley does not reach the upper drum, and accordingly is only subject to the wearing action of the two bends at the lower pulley. If, therefore, the effect of the bends at the lower pulley is reduced to one-half, by the proposed increase in diameter of the pulley, then the actual life of the rope will be doubled, instead of only being increased by 50 per cent., as was first assumed.

Where there are more than two falls of rope, the effect of increasing the diameter of the pulleys by an amount equal to two circumferences of the rope is also very marked.

Some Continental makers point out, very rightly, the desirability of making the compensating pulleys of reasonable size. The motion over such pulleys is apparently considered as negligible by some designers (judging by the forms of construction adopted), but this point of view overlooks the movement of the rope due to the swinging of the load, and the repeated bending of the rope at the same place over a small radius has an appreciable effect upon the durability of the rope.

Although the deductions laid down here appear too simple to need elaboration, a glance at the designs of many modern cranes shows that neither the designers nor the purchasers are aware of the importance of the principles involved, otherwise we should not see modern cranes in this country with reverse bends in the ropes, and as many as eight plies of rope to carry the load on cranes of only 15 tons capacity, while at the recent Brussels Exhibition there were cranes exhibited by well-known Continental makers showing the same faults.

The "lay" of the strands and the lubrication of the rope when in use have each a considerable effect upon durability. "Lang's lay" has more than double the life of ropes of ordinary "lay," and ropes that are oiled last more than twice as long as when this precaution is neglected, as already mentioned. The superiority shown by "Lang's lay" naturally gives rise to the question why it is not exclusively used, and the answer the author has obtained from rope makers is that such ropes must be very carefully handled to avoid "kinks," and also they are found to be more liable to "spin."

The Commercial Utilisation of Peat for Power Purposes.

By H. V. Pegg.

(*Abstract of paper read before the* Institution of Mechanical Engineers, *at Belfast, July*, 1912.)

It has always appeared to the author that, in order to bring the utilisation of peat to a commercial level, the first consideration would be the utilisation of the peat as far as possible in the condition in which it leaves the boglands, without any preliminary and expensive machine treatment.

The author had the opportunity about seven years ago of experimenting with air-dried hand-cut peat, fired into a special form of gas-producer. With all gas-producers using bituminous fuel the main trouble is to get rid of the tarry by-product. In this instance the gas-producer was arranged to work intermittently, there being periods of "blowing" during which the fuel in the producer was urged to incandescence, and periods of gas-making during which the tarry by-products were passed through the incandescent fuel where they were split up into gas. The chief difficulty experienced with this plant was the high thermal value of the gas generated, about 330 B.Th.U. Owing to the high and varying percentage of hydrogen in the gas, it proved unsuitable for use in the works gas-engine; and although the plant was running more or less continuously for 10 days driving the whole works, very considerable trouble was experienced, not only in the engine, but also in the plant, owing to the varying moisture content of the peat, the producer plant being decidedly sensitive in regard to this latter point.

From the experience then gained it appeared evident that it would be wiser to extract the tar from the gas, rather than to try to utilise the same by converting it into gas, and further that the producer must be comparatively non-sensitive to the amount of moisture in the peat fuel. Some two years ago the author discussed the question of the utilisation of air-dried peat fuel with Mr. Hamilton Robb, of Portadown, who, having large supplies of such fuel convenient to his factory at Portadown, was strongly of opinion that it should be possible to utilise such fuel in order to generate the power required in the factory. As the result of various tests run with an experimental plant at the works of Messrs. Crossley Brothers, Openshaw, a special plant was eventually manufactured by them under their designs and patents and to the author's specification. This plant has been running since last September.

Last October it was subjected to a test run of six hours' duration with a load of 250 B.H.P., the peat consumption per B.H.P.-hour averaging 2·55 lb., the peat fuel containing 18·98 per cent. of water; this was with both producers running, although the load was considerably below the total capacity of the plant. When necessary it has been found that the above load can be safely carried with either producer working singly, and the plant has run under these conditions for several days.

The percentage of moisture in the fuel during the above test was unusually low, owing to the unusually dry summer of 1911. During November and especially December last the fuel fed to the plant was extremely wet, as the rainfall in those months was very heavy and the fuel supply was and is entirely exposed to the weather. The plant, however, worked just as well with sodden peat as it did with the drier peat, the only difference being the amount of fuel consumed. The amount of water in this "sodden peat" varied considerably from day to day; as near as could be estimated, it was at least 70 per cent.

The separation of the tar from the gas was the chief difficulty to be overcome; it was found far better to rely on an ample water-spray through which the gas passed than any form of coke-scrubber, as the coke rapidly became clogged with tar. The main portion of the tar was thrown out into a tar sump by a centrifugal tar extractor; but unless the gases were subjected to a thorough washing and cooling by the water-spray above referred to, it was found that a certain proportion of tar got past the extractor, collected in the gas mains and finally found its way into the gas engines. It was a matter of experiment as to the precise amount of water sprayed into the cooler which was necessary in order to ensure that the tar vapour should be sufficiently condensed before reaching the centrifugal extractor, so as to enable the extractor to effect the needful separation. As now arranged, the proportion of tar in the gas after passing the extractor is small, and the engine valves do not want cleaning out more than once a week.

When first started, the plant generally, and especially the producers, required a thorough cleaning once a week; at the present date the plant can be run if necessary for three weeks without cleaning, though the weekly cleaning generally takes place as a matter of policy. This result has been obtained owing to the increased amount of washing water used, which now amounts to about 7 gallons per B.H.P. per hour. The proportion of tar recovered is about 5 per cent. of the weight of fuel consumed, and during the initial stages of the running of the plant a certain amount of this tar was sold to tar-felt manufacturers at a price of 35s. per ton, but sales in this direction ceased owing to an, at present, ineradicable pyroligneous odour which persistently clings, not only to the tar itself, but to all the various oils distilled therefrom.

Experiments have also been made with the tar in oil-burning boilers, but owing to the very high percentage of water in the tar —up to 50 per cent.—and the large quantity of solid matter also present, a very large amount of preliminary treatment is necessary. At the present time the whole factory at Portadown is run entirely on peat fuel, the consumption being about 44 tons per week, of which the producer plant takes about 22 tons. The nature of the peat varies considerably; with good black heavy peat the weekly consumption for all purposes drops as low as 35 tons; and with light top peat from the surface of the boglands the consumption rises to 54 tons. The barges bring a load of 35 tons with heavy peat and 24 tons light peat. The peat is unloaded from the barges and conveyed to the producer platform and boiler house by a transporter. Clinker troubles are not often experienced, and only when burning the inferior grade of peat, the presence of sand in the fuel causing the trouble.

The author is indebted to Mr. W. A. Mullen, manager at the factory of Messrs. Hamilton Robb, Ltd., for the following figures

in regard to the cost of fuel, these figures being given on the 12th of June last :—

Cost of Running Factory on Coal per week :—

8½ tons of anthracite at 35s. ...	...	£14	17 6
19 tons of steam coal at 17s. ...	...	16	3 0
		£31	0 6

Cost of Running Factory on Peat per week :—

Say up to 50 tons of peat at 6s.	...	£15	0 0
Weekly saving ...	...	£16	0 6

Allowing for 15s. for extra labour, the net weekly saving figures out at £15 5s. 6d.

ANALYSIS OF SAMPLE OF PEAT.

(*Received on September 14th from Mr. Hamilton Robb, Portadown.*)

PROXIMATE ANALYSIS.

	Per cent.
Water	18·98
Volatile matter	55·17
Fixed carbon	24·75
Ash	1·10
	100·00

ULTIMATE ANALYSIS.

	Per cent.
Carbon	44·60
Hydrogen	5·42
Nitrogen...	0·97
Ash	1·10
Moisture	18·98
Oxygen (by difference)...	28·93
	100·00

ANALYSIS OF AVERAGE SAMPLE OF GAS DURING A 10-HOURS' TRIAL.

Moisture in Fuel 26 per cent.

CO_2	10·6
CO	21·0
H_2	13·0
CH_4	3·7
Total combustible	37·7 per cent.
Calorific value (calculated from analysis)...	144·0 B.TH.U.

THE PARKS ELECTRO-CYANIDE PROCESS.*

BY JOHN R. PARKS.

HERETOFORE, practically all successful metallurgical processes in which cyanide salts have been used to extract gold and silver from their ores have contemplated :

1. Removal of coarse particles of the precious metals by amalgamation in a separate device before the ore is submitted to cyanide attack.

2. Presentation of the more or less finely crushed ore to chemical attack by an aqueous solution of cyanide salt, to which is added an alkali to neutralise acid radicals of the ore, to save cyanide salt ; this solution must also contain oxygen, either the normal amount that water will dissolve from the atmosphere, or a super-abundant amount added by aero-agitating devices.

3. Separation in a clear state, by settling and filtering devices, of the aqueous solution containing gold and silver cyanides, unused cyanide salt, and complex impurities, cyanates, sulphocyanates, &c., of the base metals.

4. Continued and perfect contact of the cyanide solution with the shavings or dust of an inexpensive base metal which precipitates part or all of the precious metals.

5. Separation of the precipitated precious metals from the remaining base metal, washing, collecting, drying and compressing the finely divided precious metals for melting and casting into bullion.

The object of the Parks electro-cyanide process is to apply economically all of the chemical and physical forces necessary to extract and collect the precious metals, applying them at their highest potency, and simultaneously. This necessitates economy in chemicals, their almost instant presentation under their best operating conditions to every particle of precious metal in the ore, and for only such length of time as is required for a thorough chemical interchange. That this has been accomplished will be shown by quoting results of its application to simple and to refractory ores ; all of these ores, in their raw state, were made to yield their precious metals rapidly in the form of amalgam, in a single operation, in a single machine, eliminating all filtering and precipitating devices.

PARKS ELECTRO-CYANIDE PAN.

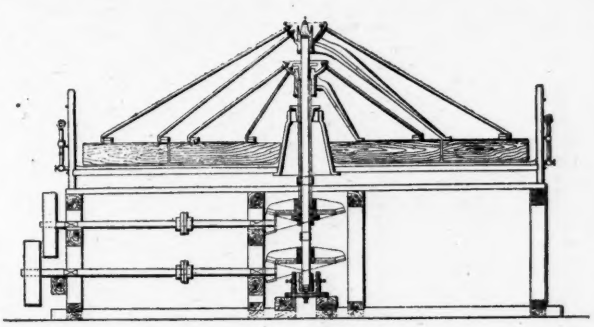
The Parks electro-cyanide pan consists of a wooden tub, 15 ft. diameter and 30 in. deep, through the centre of which projects a small conical casting for the passage of the working shafts. Practically the entire bottom of the pan is covered by an amalgamated copper plate, to which quicksilver is automatically added during operation, in proportion to the amount of precious metal in the ore being treated. About 9 in. above the copper, or cathode, plate, a cast-iron anode plate equal in area to the copper plate is mechanically suspended. The cast-iron plate is divided into two annular rings, the outer one containing 60, and the inner one 40 per cent. of the anode area.

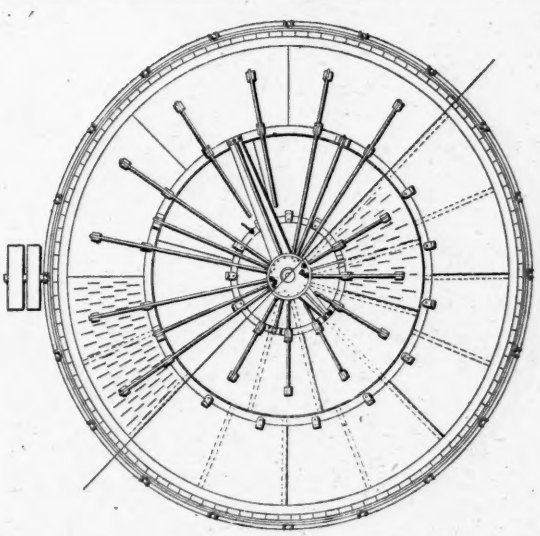
* *School of Mines Quarterly*, Columbia University, July, 1912.

These annular anodes are revolved in the same direction, and independently, by means of pulleys, gears, and a solid and a hollow shaft, so that any midway point of the inner ring travels practically the same number of feet per minute as any midway point of the outer ring. On the lower side of each of the anode rings, wooden paddles 7 in. deep are fastened radially, about 5 ft. apart, the bottom of the paddles being 2 in. above the copper plate.

The compound rotary motions of the anode rings and their paddles give to the pulp confined between them and the cathode plate a very uniform spiral motion outward, keeping the ore in a perfect state of suspension, and at a little higher speed than pulp travels down a stamp-battery plate. By the centrifugal force of the paddles, the pulp on reaching the staves of the pan is forced up between them and the outer edge of the outer anode to a height of about 16 in. above the anode, retaining the rotary motion imparted by the paddles and now endeavouring, by gravity, to seek the lower level at the centre of the pan ; the resultant motion is a downward and inward spiral until the ore passes over the inner edge of the inner anode, near the centre cone, when it again meets the paddles and starts to repeat its cycle of travel.

At the periphery of the pan, and on a level with the cathode plate, 20 jets of compressed air are admitted through needle valves set at regular intervals around the pan. The air pressure—about 12½ lb. per sq. in.—is sufficient to overcome the centrifugal force of





THE PARKS ELECTRO-CYANIDE PAN.

the pulp against the valve exits and to keep them clear. The amount of air is calculated from the oxygen demanded by Elsner's formula for dissolving the precious metals by cyanide salt, with an allowance for unavoidable waste in mixing. The air, on leaving the valves, travels against the outward spiral motion of the pulp between the anode and cathode plates, and nearly all the excess makes its appearance as a slight effervescence around the centre cone, being thoroughly incorporated with the pulp ; comparatively little escapes by rising to the surface without passing between the plates. At 100 lb. pressure, 1½ ft. of air per minute is an ample supply for the pan during treatment.

The writer, during the past eight years, has experimented with iodine, bromine and many other chemicals, seeking economy and efficiency, and has found nothing so effective and economical as commercial potassium or sodium cyanide, or the commercial double salt, together with common lime and common salt, aided by the sodium amalgam and caustic soda generated by the process.

The electrical factor of the process, which consumes from 75 to 80 per cent. of all the physical power necessary to operate it, and accounts for the speed, efficiency and economy of this as compared with other processes, is worthy of considerable attention.

From a 10 to 12-volt, 400-ampere, D.C. generator, the positive wire, after leaving the switch and indicator board, is led to the mechanical portion of the pan in four branches, each of which terminates in a suitable brush ; two play against a copper col-

lecting ring on the solid shaft which drives the outer annulus of the anode, and two against a similar ring on the hollow shaft which drives the inner annulus of the anode. By this means, the electric current passes up the vertical driving shafts, insulated from the cone through which they pass, and proceeds down the driving arms and supporting rods to the anode annuli, where it is uniformly distributed.

The negative wire from the electric generator, after passing through the switch and indicator board, also terminates in four branches, each of which connects with a copper tail piece projecting through the pan, each tail being a portion of one of the four segments of the copper plate forming the cathode. Owing to the insulation of the machine, all the electric current must pass from anode to cathode through the pulp.

In treating a charge consisting of 7½ tons of ore (dry weight) with an equal weight of water, and containing its quota of lime previously added during the crushing of the ore, such an amount of strong cyanide solution is added as to equal 1 lb. of cyanide salt per ton of ore in the pan. The correct weight of cyanide per ton of ore may be previously determined by titrating filtered samples from the pan charge during a test run for cyanide consumption. After addition of the cyanide, finely crushed common salt is added until the ammeter registers 300 to 500 amperes, at 9·5 to 10 volts, as determined by a test run. The pan is then put in motion, the air is turned on, and the quicksilver is put into its distributor.

Many complex chemical compounds are formed, some of which are decomposed, in a manner which baffles the skill of the electrochemist to explain, but among the established effects of the electric current the following may be stated :—

The salt is decomposed by the electric current and metallic sodium is constantly precipitated on the mercury-coated copper plate, forming sodium amalgam ; the sodium is converted into caustic soda, by its reaction with water, which, uniting with acid radicals in the ore, protects the cyanide from compounds from which the lime does not so readily protect it, thus saving a much larger portion of cyanide salt than can be saved without the current. Chlorine is also generated, but rarely indicates its presence, probably being united with basic radicals of the complex charge.

These several ions travel very slowly in quiet solutions, but in this mechanical device the pulp travels an average of seven miles over the copper plate in a 2½-hour treatment, presenting the cathions rapidly for discharge and deposition. This is analogous to the method by which copper is precipitated on a platinum dish, in modern electro-analysis for copper, by a revolving anode in a small fraction of the time required for precipitation in quiet solutions.

The cyanide anion probably seizes a potash or soda radical and is reconverted into nascent cyanide salt, unless a particle of precious metal, for which it has a greater affinity, presents itself first. However, there can be no question as to the so-called restoration of cyanide, for the writer has frequently found much more free cyanide of potash or soda in a sample of solution taken a half-hour or an hour after a previous sample.

Theoretically no mercury can be lost by scouring or flouring in the charge, as any subdivided particle of this metal too small to seek the cathode by gravity is sufficiently small to yield to electro-cyanide solution, whereby it is electro-chemically precipitated back on the plate. Practically, a small amount is lost, for in a 2,500-ton run on Ruth ore a loss of about 5 lb. was reported.

On samples containing 0·8575 oz. of gold per ton, the writer has reduced the average tailing sample to 0·0075 oz. per ton, showing an extraction of 99·1 per cent. by six hours' treatment in the electric pan, using 1 lb. KCN per ton of ore ; the same ore, reduced to the same fineness, yielded but 92 per cent. to solution in 48 hours' treatment in Pachuca tank (generally recognised as one of the best aero-agitating devices) using three tons of solution containing 3 lb. KCN per ton, or 9 lb. of cyanide salt per ton of ore.

Many of our western precious-metal ores from oxidised zones are contaminated by carbonates of lead, zinc and copper, which preclude economic treatment by the ordinary cyanide methods, owing to the difficulty in precipitating the precious metals in the presence of the cyanides of the base metals, aside from the excessive consumption of cyanide salt. The electric current, however, precipitates the base metals as well as the precious metals, on the amalgamated plate. The writer has produced, by the electric pan, bars of bullion worth $1,200 or $1,400 which averaged but 512 fine in precious metals, the other 50 per cent. of the bars being lead, zinc and copper, alloyed with the precious metals. The refining charges on such bullion are low.

As precipitation of precious metals takes place more rapidly from strong than from weak solution, in treating certain ores economy can be introduced by discharging the pan at a fixed value of unprecipitated precious metals in solution (50 c. to $1 per ton). After passing the charge through a revolving settler used as a precautionary amalgam trap, it may then be sent through a Dorr thickener, whereby 50 per cent. of the solution from a 1 : 1 charge, and 80 per cent. of that from a 1½ : 1 charge, can be returned clear for original charges ; this not only saves time and increases the daily capacity of the plant, but secures a higher percentage of recovery of the precious metals, while preventing undue waste of common salt and unused cyanide.

The total horse-power required for a single pan is 0·6 H.P. for mechanical agitation ; 1 to 1·5 H.P. for compressed air ; and 4·5 to 6 H.P. for electric current.

The capacity of the pan depends on the amount and character of gangue in the ore and on the nature of its precious metal minerals. The proportion of gangue determines whether one ton of ore may be treated with 1 ton or will require 1½ tons of water ; none but the very clayey types require 1 : 1½ charge.

A single pan charge of the 1 : 1 class is 7·5 tons of ore, dry weight, and of 1 : 1½ ore, is 6 tons ; the time required for treatment varies from 1 to 12 hours, generally being 2½ to 4 hours ; hence the capacity of the pan, allowing for charging and discharging, varies between limits of 15 and 90 tons per diem, but on the average run or ores it varies from 36 to 60 tons per diem.

The large capacity of the pan, the small tonnage of ore under treatment in the mill at one time, and the small amount of machinery and apparatus required, reduce the total cost of installing mills using this process to 30 to 60 per cent. of the amount necessary to install any other process of equal daily capacity.

A few examples will show the efficiency of the process.

Ruth Gold Mining Co.'s mill, Kingman, Arizona.—Daily capacity 50 tons. Quartz ore with large amount of manganese minerals ; little free gold. Values occur in sulphide minerals ; ratio of gold to silver 1 to 12. Test in 40-in. testing plant. Pan charge, 215 lb. : 1 lb. KCN per ton of ore, six hours' treatment ; 200-mesh pulp. Results : Precipitated as amalgam, gold 96·76 per cent. ; silver, 87·7 per cent. ; monetary values, 95·6 per cent. Shortly after the mill was turned over to the Ruth Co., three pans being used each with 7½-ton charges, the mill foreman's samples and his assayer's results showed as follows :—Precipitated as amalgam, gold 96·66 per cent. ; silver, 87·77 per cent. ; monetary values, 95·09 per cent. ; 1 lb. KCN per ton of ore, six hours' treatment ; value of ore, $18 per ton.

Maginnis Mill, Maiden, Montana.—One pan ; 7½-ton charge ; 30-mesh pulp. Oxidised ores containing 0·33 to 0·50 oz. gold and from 1·5 to 4 oz. of silver per ton, contaminated with carbonates of lead, zinc and copper. One pound KCN per ton ; 2½ hours' treatment. Precipitated as amalgam, 86 to 92 per cent. gold, 62 to 72 per cent. silver. The low silver contents of this ore prohibited the economic use of cyanide salt in stronger solutions, in order to secure higher extraction from its silver minerals.

Gold ores from Kendal, Fergus County, Montana.—Decomposed, porous limestone, impregnated with gold ; an ideal cyanide ore. Test of 225 lb. in testing pan ; 12-mesh ; 1 lb. KCN per ton ; after one hour, 90·5 per cent. of gold as amalgam ; after 2½ hours, 97 per cent. of gold contents of the ore reduced to amalgam. Ore valued at $8 per ton in gold.

Orient, Washington.—Auriferous, fine crystals of pyrite in andesite ; no free gold. Average value, 1·03 oz., $21 29 per ton. Four hours' treatment on 230 lb. lots ; 4½ lb. NaCN ; pulp 120-mesh. 95·35 per cent. of gold contents saved as amalgam.

Whitman Mine, Pearl, Idaho.—Ore contained arsenical pyrites, 25 to 27 per cent. ; pyrite 40 per cent. ; gangue 35 to 37 per cent. Six hours' treatment with 4 lb. KCN ; 120-mesh. Gold, 1·3385 oz. per ton, worth $27·67 ; saved in form of amalgam, 88·8 per cent.

Metates Mine, Sinaloa, Mexico.—Ore contained 5 per cent. pyrrhotite, with galena and antimonial sulphide minerals, in quartz gangue. Twelve hours' treatment ; 230 lb., 120-mesh ; 12 lb. KCN used ; 7·7 lb. consumed. Gold, 0·625 oz. ; silver, 63·015 oz. ; value, $44·43 per ton. Extracted in form of amalgam, 99 per cent. gold, 91·1 per cent. silver.

All of the results cited above were obtained by direct pan treatment, without returning any solution once passed through the pan.

PARLIAMENTARY.

Falkirk Electric Lighting Order.

The inquiry into the Provisional Order promoted by Falkirk Town Council for the extension of the burgh boundaries was concluded last Friday, when Sir John Dewar, the chairman of the Commission, intimated refusal of the Order.—Mr. C. M. Aitchison (advocate) represented the Falkirk and District Tramway Co., while Mr. James Keith (advocate) was counsel for the Scottish Central Electrical Power Co.—Mr. C. D. Murray, K.C., addressing the Commissioners on behalf of the objectors, said there had been no change in circumstances since the burgh's last application for powers to extend. The only pretence of change was that Mr. Balfour had promoted his Electric Lighting Order for the districts which the town now wanted to annex. The apprehension that the gas undertaking of Falkirk would suffer by electrical competition was an absolute bogey.—Mr. Balfour Browne, K.C., replying on behalf of the promoters, said the Balfour Order was one reason for the burgh being before the present Commission with an extension scheme. If Mr. Balfour had got his Order before they promoted their extension scheme that scheme would have been blocked, and it would have been said that they had not been supplying electricity. That was one of the reasons why the Town Council did not oppose Mr. Balfour's Order. The whole question had been one of tactics.—Mr. James Learmouth, county clerk, in the course of his evidence, spoke of the attitude of the County Council with regard to Mr. Balfour's Electric Lighting Order. Mr. Balfour agreed to supply the County Council with electric light on reasonable terms, and the County Council made that a condition for not opposing the Order. The Town Council were very anxious that the County Council should oppose the order, and they had a conference with the Town Council on the subject. The proposal was made at that conference that if the Town Council promoted an Electric Lighting Order the County Council should take their electricity in bulk from the Corporation. Witness pointed out that he did not see what difference the electric lighting was to make to the Corporation gas undertaking if the electricity was taken from the Council or Mr. Balfour in bulk. If the Council had promoted an order to supply electricity to the districts the rates would be fixed by Parliament. At the conference Treasurer Wallace said he would be satisfied if the

County Council promoted an Electric Lighting Order of their own. That was said without any question as to their taking any supply from the burgh. It was afterwards that it became a *sine qua non* that the electricity should be taken from the burgh. Then the burgh had extension so little at heart that the Town Council said that if the County Council promoted an Electric Lighting Order, the Town Council would indefinitely postpone another Burgh Extension Order. The inquiry lasted over 11 days.

Royal Assent. — Among the Acts to which the Royal Assent has just been given are the following :—

Electric Lighting Orders Confirmation Acts, Nos. 1, 2 and 3.
Bradford Corporation Trolley Vehicles Order Confirmation Act, 1912.
Tramways Orders Confirmation Act, 1912.
Clyde Valley Electrical Power Order Confirmation Act, 1912.
North Ormesby, South Bank, Normanby and Grangetown Railless Traction Act, 1912.
Bognor Gas Light and Coke Co. (Electricity) Act, 1912.
Metropolitan District Railway Act, 1912.
London United Tramways Act, 1912.
Preston, Chorley and Horwich Tramways Act, 1912.
London Electric Railway Act, 1912.
Edgware and Hampstead Railway Act, 1912.
Ericht Water and Electric Power Act, 1912.
Lanark County Tramways Act, 1912.
National Electric Construction Co., Ltd., Act, 1912.
Midland Railway (L.T. & S.R. purchase) Act, 1912.
Metropolitan Railway Act, 1912.
L.C.C. Tramways and Improvements Act, 1912.

AUSTRALIAN TRADE.

The directions which were recently issued to the Victorian Railway Commissioners for the future, and to which reference is made in our leading columns this week, include the following :—

"Taking into consideration the quality, time of delivery, and price of the goods, orders are to be given to British manufacturers as against foreign tenderers. Wherever the Commissioners recommend an order for a contract to be entered into with a foreign tenderer, they must, under the conditions of the Act, for the future, explicitly state their reasons in a memorandum to the Minister, who will then decide, in view of all the circumstances presented to him.

"Other matters came up in connection with the inquiry. One is that although certain regular contracts are entered into by the Commissioners with Australian and oversea contractors, there are some considerable quantities of materials purchased, apparently for emergency work ; and although invitations to quote for these materials are publicly advertised, in accordance with the Railway Act, we feel that quite a number of lines purchased in this way should be included in the biennial and periodical contracts. We propose to give directions, therefore, so that the goods purchased on quotation in this way shall be reduced to the minimum.

"Questions arise as to the encouragement that should be given to competitive tendering. It has been alleged, and the Government is satisfied that it is true, that the time allowed to distant tenderers to consider the specifications and requirements of the department is not sufficient to elicit the widest competition. We propose, therefore, to recommend that more time be in future given to firms who have not all the data at hand in Australia, so that they shall have time to send particulars home by the mail, and send their offers out by the mail.

"Some of the tenders—and they are from reputable business houses in England—have been rejected for tires, wheel centres, axles and blooms, because the chief mechanical engineer, studying the matter from the standpoint of public safety, said that the goods were not sufficiently known to him to warrant their acceptance at the price, although, in some cases, the prices were lower than those of the accepted tenders. We found that many of these firms have been for many years supplying most of the other Australian States in these particular lines, and that the specifications for their goods complied with the requirements of the British Board of Trade. We decided that offers from firms of this character in future shall not be rejected on the ground of the goods not being known, but that where their business has been so wide-spread with British and Australian railway companies and States, if their prices do not justify acceptance of all their tenders, trial orders should be given to them to test the durability of their goods.

"It is the practice of the Victorian Railway Department, apparently alone amongst all the States of Australia, to insist on applying tests, chiefly at Newport, to goods ordered, particularly rolling stock. This, we find, has a tendency to be objected to by many British manufacturers, and within a limited area there is objection amongst tenderers. We consider that, for the future, the place of the tests should be at the point of manufacture, and that a specially qualified engineering officer should be appointed to take charge of this work. No officer should be kept at it for more than about 12 or 18 months. We believe that, if such men as these are sent abroad, as was done in connection with the engines recently imported from the Baldwin works, and Beyer, Peacock & Co., they will secure a wider experience, which, when they return to Victoria, will be of great use to the construction branches of the railways.

"There have been a great number of cases revealed in the inquiry of a tender being accepted by the Railway Department which was not the lowest. This applies to all kinds of goods, British, foreign and Australian, and it appears to the Government that, unless there are good and sufficient reasons that could be suggested for this by the recommending officer, and endorsed by the Commissioners, for the acceptance of the higher tender, the lowest tender should, in the ordinary course of business, be accepted."

LEGAL.

Attorney-General *v.* The London Electric Railway Co.

The Attorney-General, at the relation of the Gordon Hotels, moved before the vacation judge (Mr. Justice Bankes) on Thursday, August 8th, for an interim injunction to restrain the defendant company from pumping in alleged breach of their Act of Parliament.

At the outset Mr. Bramwell Davis, who represented the railway company, asked for an adjournment to answer the plaintiffs' evidence. The matter, he said, was one of great importance to his clients, and they only had the plaintiffs' affidavits on Tuesday. He asked that the motion might stand over for a fortnight.

Mr. Felix Cassel, who appeared for the Attorney-General, said he had no objection if the defendants would undertake to do no more pumping in the meantime.

Mr. Bramwell Davis said he could not do that.

His Lordship asked whether the defendants' Act of Parliament did not prevent pumping.

Mr. Bramwell Davis said they commenced pumping in December last, and had been going on ever since. The plaintiffs knew of the pumping last March.

Mr. Cassel pointed out that that would not affect the Attorney-General.

Mr. Bramwell Davis said the pumping could not do the relators any harm, and his contention would be that this was not vacation business. When he came to argue on the construction of the Act of Parliament, he should submit that the defendants were not doing anything in breach of the Act.

Mr. Cassel said that the Act of Parliament expressly prohibited pumping. The plaintiffs first knew what was going on in March, and they at once communicated with the defendants. Not being satisfied, they sank a shaft on their own land, and on June 17th discovered that the water had fallen 3 ft.

Mr. Bramwell Davis said that as they knew what was happening so long ago as June 17th, he should submit that this was not vacation business, but if his Lordship thought the motion ought to come on in the vacation, he must ask for time to answer the evidence. The importance of it was that if this pumping was stopped serious consequences might arise with regard to the whole of the electric railway system. This pumping was at present taking place in close vicinity to some new works of the District Railway. The works were, in fact, a transformer station, which, if stopped by flood, would affect three railways, as the electricity was taken from the transformer station for a portion of each of them. If the station were flooded the three railways must be stopped.

His Lordship thought that if this had been going on since December last a fortnight's adjournment could not hurt the plaintiffs.

Mr. Cassel said things had been getting worse and worse. The plaintiffs, it was true, first found it out in March, but they were given assurances by the defendants' engineers, which appeared to be satisfactory. Since then the plaintiffs had taken steps by digging a hole on their own premises to ascertain exactly what was happening, and had discovered that a point had been reached when any further abstraction whatever would be a very serious thing to the Hotel Metropole and other buildings in Northumberland Avenue.

His Lordship thought the defendants must have an opportunity of answering the evidence.

Mr. Cassel asked that the adjournment should be for a week only.

Mr. Bramwell Davis said they wanted to place before the Court the best expert evidence that could be obtained, and it was difficult to procure at this time of year.

His Lordship directed the motion to stand over for a fortnight.

Mr. Cassel asked that the defendants' evidence should be filed by next Monday week, so that the motion might be effective the following Thursday, and, further, that the defendants should undertake not to increase their pumping in the meantime.

Mr. Bramwell Davis said they did not propose to increase the pumping, and would not, unless something unforeseen occurred. They would do their best to have their evidence ready by next Monday week.

On that understanding his Lordship directed the motion to stand over until August 22nd.

Torquay Electric Supply.—At a meeting of the T.C., the electrical engineer (Mr. C. W. Salt) reported that, in consequence of the increasing demand for current, more plant would shortly be required, and he recommended the installation of a 1,000-kw. turbo-alternator, at an estimated cost of £6,500, in the winter of 1913-14. The Committee recommended that the Council invite tenders for this plant, and that £3,000 be taken out of revenue towards the cost. Mr. W. Langton said that if this plant were obtained it would not be necessary to remove the station to another site for many years. The alternating current supply had increased by something like 60 per cent. Mr. J. Glanfield thought the consumers should be considered in this matter. They were entitled to a price reduction. Mr. E. T. Blackler said that as a matter of fact a reduction was probable shortly. The report was adopted.

BUSINESS NOTES.

Bankruptcy Proceedings.—Thomas Parker, 66, Friar Stile Road, Richmond, late 44, Mortlake Road, Kew Gardens, Surrey, engineer.—The receiving order herein was made on a creditor's petition, and according to the accounts filed the liabilities amount to £530, to meet which there are no assets. It appears that the debtor was articled to a firm of engineers, and stayed with them until 1890. He then travelled abroad for them until 1897, and also acted as a general consulting engineer on his own account. In that year he returned to this country and formed the Electric Street Car Syndicate, Ltd., of which he became managing director, at a yearly salary of £350. The business did not prove successful, and at the end of 1899 it was sold, and the debtor became chief engineer to a limited company in Cheshire, at £350 per annum and a bonus which averaged £100 a year. In 1902 he left them and opened offices at Darlington Street, Wolverhampton, and at Colmore Row, Birmingham, where he traded as a consulting engineer until 1904. He then came to London to act as engineer to a motor company, with a salary and 5 per cent. on the net profits, amounting to about £400 a year. In June, 1905, he left their employ and opened offices at 217, Piccadilly, trading on his own account as a consulting engineer. Subsequently he removed to Holborn, where he acted as chairman of a company and carried on his own business. He was also chairman of another limited company in connection with motor-cars, which did not prove successful. The debtor invented and patented an electrically-wound regulator clock, for three of which he obtained orders at £75 each. These clocks, however, were not satisfactory, one was sold and the other two are in his wife's possession. He incurred law costs and expenses to the extent of £1,000, of which £600 could only be recovered in connection with the manufacture of these clocks. He also invented and patented a carburettor and a new steering gear, for which his wife provided the money. In order to exploit the patents he entered into partnership with two others, and traded at 18, Berkeley Street, Piccadilly. A partner was introduced in October, 1910, and put in a capital of £3,000 and paid a premium of £750 to the then partners. He had to sue for his share of the premium and he recovered £250, which was paid to his wife, to whom he had previously assigned his interest therein and all his other assets. A private company was formed to work his inventions, his shares being allotted to his wife. A resolution for voluntary liquidation was passed in March of last year, and an injunction was obtained against him restraining him from going on the company's premises. In July, 1911, he and his wife surrendered all their shares in the company in consideration of their being released from the company's costs against him in respect of an abortive attempt by himself and his wife to obtain a compulsory winding-up order, and on his giving a promissory note for £50 at six months. This promissory note, however, he failed to meet, and it came into the possession of another, who obtained judgment against him and filed the petition. The failure is ascribed to losses in business ventures with others, and the law costs of proceedings arising therefrom. No books of account appear to have been kept. The following are creditors :—

Banks, G.	£248	Burrell & Payne	£13
Parker, C. H.	100	Edwards, Evans & Co. ..	25
Wall, N. C.	82		

Henry Hallifeld Oxley (otherwise known as Oliver Huxley), consulting engineer, 22, Uxbridge Road, Hanwell, Middlesex.—The adjourned first meeting of the creditors of the above was held on Monday, August 12th, at the offices of the Official Receiver, 14, Bedford Row, W.C., Mr. F. T. Garton, Assistant Official Receiver, presiding. The statement of affairs showed unsecured liabilities amounting to £1,423, and assets estimated to produce £116 10s. The Official Receiver having again dealt with the proofs, said that the meeting had been adjourned at the debtor's request, to enable him to bring in a scheme of composition, but no such scheme had been lodged. The debtor's solicitors said it was still his intention to propose to the creditors a composition of 7s. 6d. in the £, and he had every reason to hope that the necessary funds would be forthcoming from the debtor's friends if the meeting were further adjourned. He suggested a month's adjournment, as it was exceedingly difficult at this time of the year to get into communication with people and complete details. A creditor: As far as the debtor is concerned, we have had experience of some of his promises. They have not always been fulfilled. If someone could show that he had been in communication with the debtor's friends on the matter, and the subject was being entertained, it might be different. The solicitor said it was only on the previous day that negotiations with the family had broken down. Up to a few days ago there was every reason to suppose they would have assisted. Debtor: I may say these negotiations may still go through—it is simply a matter of using some persuasion. After some discussion, the Official Receiver said it was a matter for the creditors. So far as the assets in the statement of affairs were concerned, there was nothing to be jeopardised by delay, but his experience was that even in the most hopeless cases debtors were in the habit of urging adjournments in some vain hope of something turning up. The solicitor said the debtor's friends would still help him; in fact, they blamed him for not going to them before the receiving order was made. Creditors complained of the probability of being brought to another meeting unnecessarily, but the Official Receiver pointed out that if there was a proposal to be lodged, it must be done so that the creditors could have it before them prior to the next meeting. If there was no proposal, it would not be necessary for them to attend, but simply to send a proxy in favour of adjudication. He did not think it would be a case for adjournment after this. It would be no use blaming the time of the year—that was no reason for these adjournments. Eventually the creditors agreed to give the debtor an opportunity of bringing in his scheme, and the meeting was, therefore, adjourned, the debtor's solicitor undertaking to pay the costs of calling the further meeting.

Andrew George Adamson, electrical engineer, Acton, and late of Christopher Street and other addresses in London.—A third dividend of 7¾d. in the £ is now payable at the Official Receiver's office, 14, Bedford Row, W.C.

T. M. Mackay, 15, Beresford Terrace, Ayr, trading as T. Mackay and Co., electricians, and as the Ayr County Motor Co.—In Edinburgh Bankruptcy Court on the 6th inst., the debtor appeared under sequestration of his estate. There were no questions. The statement of affairs showed that the liabilities were £7,658 and the assets £1,936.

Joseph Perkins, electrical engineer, Ebrington Street, Plymouth.—August 31st is the last date for the receipt of proofs for dividend, by Mr. A. N. F. Goodman, 7, Buckland Terrace, Plymouth, the Official Receiver.

Dissolutions and Liquidations.—Lamplough and Son, Ltd., mechanical, electrical and general engineers, Albany Works, Willesden Junction, N.W. Under a winding-up order made last May, meetings of the creditors and shareholders were held on Tuesday, at the Carey Street Offices of the Board of Trade, Lincoln's Inn Fields, W.C., Mr. W. J. Warley, Official Receiver, presiding. The accounts filed under the liquidation showed unsecured debts £12,572; loans on debenture bonds, £8,910; and preferential claims, £124; making a total indebtedness of £21,606. The assets are valued at £12,316, and after allowing for payment of the debenture and preferential claims, there remains an estimated balance of £3,282 to meet the unsecured liabilities, consequently there is a deficiency of £9,290 in assets to meet the liabilities of the company, and a total deficiency of £15,583 as regards contributories. The failure of the company is attributed to mismanagement, and to the fact that large quantities of parts of engines, &c., which were in an experimental stage, were ordered, and the company has not been able to utilise them. Mr. Lamplough does not admit that the company is insolvent. Mr. H. J. Gully, C.A., was appointed to act as liquidator with the assistance of a committee of inspection.

Electric Prepayment Meters, Ltd.—This company on July 15th, resolved upon voluntary liquidation, with Messrs. B. Bernheim and F. E. Stanley, as liquidators. A meeting of creditors is called for August 21st, at 3, Laurence Pountney Hill, E.C.

Digby & Biggs, inspecting and consulting engineers, 28, Victoria Street, London, S.W., and 49, Deansgate, Manchester.—Messrs. W. Pollard Digby, C. W. V. Biggs, and A. C. Heap, have dissolved partnership. Debts will be attended to by Mr. Digby, and the business will be in future carried on by Messrs. Digby and Heap, under the style of Heap & Digby.

Bradford Electrical Co., Ltd.—A meeting is to be held on September 16th at 56, Market Street, Bradford, to hear an account of the winding up from the liquidator, Mr. J. H. Haley.

Book Notices.—"Science Abstracts," Sections A and B. Vol. 15, Part 7. July 25th, 1912. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

"Boiler Explosions, Collapses and Mishaps." By E. P. Rimmer. 1912. London: Constable & Co. Price 4s. 6d. net.

"*Proceedings* of the Engineering Association of New South Wales." Vol. XXV. Sydney, N.S.W.: The Association.

"Modern Illumination." By Henry C. Horstmann and Victor H. Tousley. 1912. London: The American Book Supply Co., Ltd. Price 8s. 6d. net.

"*Journal* of the Municipal School of Technology, Manchester." Vol. V. Manchester: The School.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXI, No. 7. July, 1912. New York: The Society. Price $1.

"The Chart of the Elements." 1912. London: The Metallic Compositions Co.

"Growing Crops and Plants by Electricity." By E. C. Dudgeon. London: S. Rentell & Co., Ltd. 1912. Price 1s. net.

Trade Announcements.—Mr. G. B. Bowell, inventor of the "Silent" as well as of older forms of electric clocks, is at the end of this month giving up the active management of the Silent Electric Clock Co.'s Works, which he has controlled during the past four years. Mr. Bowell, who will continue to act as consulting engineer to the Silent Co., is commencing business as consulting engineer and advisory expert at Margate. The Silent Co., which will continue in business at Goswell Road, will be registered as a limited company, and Mr. A. Gilbey Gold will be on the board.

The Brimsdown Lamp Works, Ltd., have recently taken over an additional suite of offices with increased telephone accommodation at Kingsway House, London, W.C., and all communications should be addressed there. The new telephone No. is "7904 Gerrard" (two lines).

The British L.M. Ericsson Manufacturing Co., Ltd., announce that their London address will be altered from August 30th to Old Serjeants' Inn, Chancery Lane, London, W.C.

Mr. F. Bescoby, electrician, of 22, Grove Street, Retford, has taken his son into partnership, and the business will be carried on under the style of F. Bescoby & Son.

The Sandycroft Foundry Co., Ltd., announce that in future the title of the firm will be "Sandycroft, Ltd." They have made this alteration owing to the confusion of ideas resulting from the use of the former title, which led many people to imagine that they were makers of iron castings and heavy engineering work only, whereas, as our readers know, they have been making electrical machinery, starters, motors and generators, both D.C. and A.C., for mining and all industrial purposes, for the past 12 years.

Messrs. Lloyd Wise & Co., consulting engineers and chartered patent agents, have removed to their new offices, 10, New Court, Lincoln's Inn, London, W.C.

According to an Australian exchange, a company entitled Ramsay Sharp & Co., Ltd., has been registered in Sydney as electric lamp manufacturers, with a capital of £20,000 in £1 shares. The directors are H. W. Ramsay Sharp and R. Burgin (joint managing).

The same contemporary announces that the Lawrence and Hanson Electrical Co., Ltd., have been appointed agents in New South Wales for the Sterling Telephone and Electric Co., Ltd., London.

The Schniewindt Electric Co., 40-41, Staniforth Street, Birmingham, has been formed to take over the manufacture in this country of the specialities previously manufactured by Mr. Schniewindt, Neuenrade, Westphalia. The above premises are fitted up with new machinery for making his patent asbestos woven net resistances throughout, only British materials being used. The firm's other specialities are resistance wires, made by their German works, electric heating elements and electric heating and cooking apparatus. The new works are under the sole management of Mr. H. H. Cressall, who formerly acted as sole agent for the firm.

Catalogues and Lists.—Messrs. H. A. Jackson and Co., Caxton Works, Salford, Manchester.—Several illustrated lists, of several shapes and sizes, showing and giving prices of the following manufactures: The "Fourlite" shop fitting; "Warldin" iron-clad "Yi" type switches; electrical switch blocks; hand-beaten art metal luminous radiators and electric light fittings.

Westminster Electrical Testing Laboratories, York Street, Westminster, London, S.W.—Leaflet relating to tests of metal-filament lamps and charges for same.

Messrs. Ferranti, Ltd., Hollinwood.—A brochure of 14 sheets illustrating in appropriate colouring their Ferranti electric fires and giving prices of same.

The Cromil Engineering Co., Ltd., Milburn House, Newcastle-on-Tyne.— As sole British agent for the International Acheson Graphite Co., of Niagara Falls, this firm has issued a new eight-page pamphlet giving particulars of Acheson graphite, graphite electrodes and paint, also the "Cromil" self-lubricating packing and pipe-jointing paste.

Messrs. Simplex Conduits, Ltd., Birmingham and London.—Mailing card No. 189, giving prices and brief information respecting the "Simplex" electric vacuum cleaner.

The St. Helens Cable and Rubber Co., Ltd., Warrington.—New 16-page list giving particulars and prices of their cab-tire sheathed cables, insulating tapes, gloves, rubber mats, &c. Also a copy of the St. Helens picture book, wherein there appear a number of interesting and humorous cartoons, with which most of our readers have been made familiar already by the firm's advertisements. Each picture is accompanied by appropriate verses. Copies of either of these publications will be forwarded on application.

The Brimsdown Lamp Works, Ltd., Kingsway House, London, W.C.—Advance copy of a 12-page price list of "Wirum" lamps for various candle-powers, voltages, and shapes, and including street lighting sizes, as well as candle, flame, and tubular, and traction and train lighting lamps. Goliath holders lined with heavy metal are shown, and a 100-watt lamp, fitted with Canadian screw cap specially for export, is listed. A large inset sheet gives dimensioned diagrams of the lamps one-half their actual size. Copies may be obtained on application.

Messrs. R. H. Patterson & Co., Ltd., Forth Street Works, Newcastle-on-Tyne.—August catalogue of new and second-hand machinery.

A Manchester Rail Contract.—A contract for £11,000 worth of tramway rails led to a discussion in the Manchester City Council on Wednesday last week. The Tramways Committee proposed to accept a tender of a Sheffield firm, although that of an American firm, which had previously done much business with the Corporation, was £800 less. Councillor Bowie said they were throwing away £800 of the ratepayers' money. There appeared to be no difference in the quality, and he moved that the tender be let to the American firm. Alderman Bowes, chairman of the Committee, said he would take the matter back to his Committee for further consideration if the Council desired. The amendment was defeated. Councillor T. Fox said he was prejudiced in favour of British trade, and in Committee he voted for the Sheffield firm and took into consideration the fact that they could get quicker delivery from Sheffield. Alderman Walker said they were going to tell the people abroad that they would not give a contract there. They were going to make them retaliate on Manchester trade—a most serious thing. Finally, the Council sent the matter back to Committee, by 32 votes to 22.

A South African "Municipal Engineering Scandal."—*The South African Mining Journal* for July 13th, 1912, publishes the following:—"Winburg (O.F.S.) Municipality has, to say the least, a curious way of carrying out its civic duties. Its extraordinary methods are now exciting the ridicule of Johannesburg engineering firms because of a recent display of official bumbledom. Tenders, it appears, were lately invited for the supply of an electric lighting plant to the town, and a loan was contemplated from the Provincial Treasury to defray the cost. Several of the leading firms on the Rand put in competitive tenders, and most of them went to the expense of dispatching engineers to investigate the possibilities of the scheme. Tenders were duly opened, published, and adjudged. To the general surprise, however, though all the firms competing were of the highest standing, a tender other than the lowest was, for no ostensible reason, accepted. The accepted tender, indeed, was not nearly the lowest; in fact, there were a dozen below it, and repeated applications to the Town Clerk for an explanation of the slur thus cast on the plant offered at a lower price by the disappointed firms were met by a curt refusal to discuss the matter. The exact words were, 'the interest of the ratepayers guided the decision.' In the absence of a body such as the Home Local Government Board to investigate this extraordinary action on the part of the Mayor and Council of Winburg, it is highly desirable that the Administrator, Dr. Ramsbottom, take the necessary steps to remove the municipality in question from the stigma of the insinuations that are now being freely made against it. We are glad to notice that our contemporary, the *Friend*, has already taken the matter up; and, should the loan not yet be granted, it is to be hoped that the Administrator will in this case exercise even more than his usual strict supervision."

New Zealand.—The Customs authorities of New Zealand have lately given a decision to the effect that "electrical appliances, starting compensators, hand-operated, for alternating-current motors" are to be classified under No. 176 of the tariff, the duty on British manufactures being 20 per cent. and on foreign goods 30 per cent., *ad valorem*.

Electric Iron Records: Chapter III.—With reference to the records of endurance of domestic electric irons recently mentioned in these columns, Messrs. Eastman & Warne, of Acton Vale, W., send us a copy of a communication received from Messrs. Bowden, Higlett & Co., contractors, of Guildford, to the effect that factory irons installed in a client's workshop about four years ago have given very satisfactory results, only two having had to be repaired. "Thus in 24 iron-years there have been two failures only, an average of 12 years per iron. Since these are factory irons, run for, say, 50 hours per week, this is equivalent to a life of 120 years of a domestic iron that is but seldom used more than five hours per week."

LIGHTING and POWER NOTES.

Abyssinia.—An hydro-electric station has been built at Addis-Ababa, to supply the city with light and power. The Abyssinian Government is building a cartridge factory, which will also be supplied with current from the new station. The pressure at which the current is furnished to the city is 6,000 volts.—*La Lumière Electrique.*

Argentina.—Mr. M. Herlitzka advises that his firm has purchased the electric power houses and concessions for the cities of San Juan and Necochea. The capacity of the former is to be considerably increased by the utilisation of further hydraulic power, which will enable all the requirements of the city and suburbs for light and power to be met for many years. In Necochea, a new installation is being put down by Messrs. Siemens-Schuckert, which will considerably increase the output of the station.—*Review of the River Plate.*

Australian Farming.—At Gooramadda Park, Rutherglen (Vic.), there will be installed in October next an electrical equipment for the working of the whole of the station, containing an area of approximately 2,500 acres. The power plant will comprise two units, consisting of Babcock & Wilcox boilers, 220-H.P. Belliss engines directly connected to A.E.G. three-phase 3,300-volt 50-cycle generators. The principal motors will be operated at that voltage, and be directly connected to the pumps for the Nunan irrigation systems. All the ploughing, &c., sowing and reaping will be done by electric power, and the haulage of the lucerne and crops to the main stackyard by storage battery locomotives. Mr. F. J. Coote, late general manager of the Cassilis G.M. Co., is the consulting engineer.—*Mining and Engineering Review.*

The Sydney Municipal Council has agreed to a recommendation of its electrical engineer that legal advise should be obtained on the question of a future power station, remote from the city, with transmission lines, &c., and of obtaining Parliamentary sanction to such a scheme.

Braintree.—The question of electricity supply for the town is to be considered by the Roads and Lighting Committee, who will report on the matter at the next meeting of the Council.

Bredbury.—The U.D.C. has, subject to a payment of £1 1s. per annum, consented to Stockport T.C. supplying current from the tramways to a residence in the town; the Council has also asked Stockport Corporation to canvass the district to see what employers of labour are willing to take a supply of current.

Bacup.—Last week contracts were signed for a new weaving shed being erected at Bacup by Messrs. Hoyle Bros., of the Burnley district. The new shed will be named the Olive Mills, they will accommodate 400 looms and will be driven by electricity

Canadaian Farming.—The Ontario Hydro-Electric Commission has been demonstrating in the Niagara district the possibility of farming by electricity. The Commission purposes to order two portable threshing outfits which will tour the country this autumn, giving demonstrations of electric power for threshing, corn cutting and ploughing. During last year the Hon. Adam Beck, chairman of the Electricity Commission, together with several of his experts, studied electrical methods in Great Britain and Europe, with the object of ascertaining how far electricity could be applied to the work on the farm. The result of their researches is shown by the fact that they are now demonstrating to the farmers the advantages of electric power for the heaviest work on the farm. The movement, however, is capable of great extension, and the object of the Commission is to take advantage of everything that science offers in order to make the lot of the farmer easier.

Canary Islands.—The port, the quays, and the town of Las Palmas are lighted by electricity. The electricity supply station belongs to a Belgian company, and supplies 800 incandescent lamps for public lighting, and 39 arc lamps, whilst, at the same time, it is estimated that there are 15,000 incandescent lamps in use by private persons. There are 58 motors with a total H.P. of 250; public lighting consumes on the average 14,000 KW.-hours a month, and the private service 15,000 KW.-hours.

Cheam.—The Parish Council has decided, upon the recommendation of the Lighting Committee, to adopt electricity for the lighting of the street lamps, the opinion being that it would result in a small saving as compared with gas lighting.

Cheltenham.—The B. of G. has appointed a Committee to consider the question of lighting the workhouse premises by electricity. The board is advised that it will be much cheaper to substitute electricity for gas, as after a certain number of units are consumed the price per unit goes as low as 2d.

Continental Notes.—GERMANY.—Gueden, in Hanover, has decided on the installation of an electric service, and has given the contract for the local distribution network to the Siemens-Schuckertwerke for the sum of £12,500.

ITALY.—Our contemporary, *Elettricita*, of Milan, indicates that there is every prospect of a considerable reduction in the existing taxation of electricity in respect of the quantity used for domestic heating and cooking, and it further adds that it is even possible that electricity used in this way may be exempt from taxation altogether. The question, therefore, of electrical heating assumes greater importance, and the Italian technical factories will soon feel the necessity of turning their attention to the practical construction of suitable apparatus.

NORWAY.—The Arendals Fossekomgrani, which was formed some time ago for the purpose of erecting a large electrical iron and steel works, as well as a works for the manufacture of carborundum, has, according to *Teknisk Ugeblad*, just obtained the Government's concession for a transmission line from the waterfall of Böilefas to the works, with a branch line to the carborundum works. The total amount of electrical energy to be transmitted over this line will vary between 20,000 and 30,000 H.P.

The Tyssefaldene Electrical Works, which are situated in the south-western part of the country, and from which energy is supplied to various large industrial undertakings, among others the Hardanger Electrical Iron and Steel Works, have recently placed an order with the Norwegian representatives of the Westinghouse Co., for two three-phase generators of 13,500 H.P. each. Large extensions of the works have been decided on, and the above order is in connection with these extensions. The works have previously ordered the whole apparatus, which is now being installed from the same firm. The proposed extensions are going to be completed in the course of next summer.

LUXEMBURG.—La Compagnie Luxembourgeoise d'Electricité is the name of a new company which has just been formed in Brussels with a capital of £8,000.

BELGIUM.—The T.C. of Liége is considering the question of expropriating the electric concession, granted in 1908, to the Compagnie Internationale d'Electricité and the A.E.G. Union Electrique. The concession was only for 10 years, the T.C. reserving the right of expropriation in any one of the last five working years.—*La Lumière Electrique.*

SPAIN.—Although the electric light has already made its entry into the capital of Spain, it is only to a limited extent, and the municipal authorities have now decided upon its general introduction. Tenders are being invited for a concession for 15 years for the erection and working of a complete public service. For this purpose the city is divided into four zones, and tenderers have the option of taking one or more, or the whole of the zones. Two-thirds of the installation is to be completed by March 1st, 1914, and the whole is to be in full working order by July 21st of that year.—*Electron.*

RUSSIA.—The municipal authorities of Lemsal (Livland) are at present considering the question of establishing a central electric lighting station in the town.

Egypt.—A scheme to utilise the water-power of the Nile at the Assouan dam is mooted, a German society, of which the Deutsche Orient Bank is a member, having applied to the Government for a concession. The volume of water passing through the sluices of the dam is reckoned at 32,000 tons per minute, and its conversion into electrical energy would afford means for stimulating he whole of the present and immediately future husbandry and ndustrial interests of the country.—*Elek. und Masch.*

Greenock.—The report of the Corporation deputation which had an interview with the B. of T. in connection with the proposed order for the supply of electricity to Port Glasgow power users paves the way, for a mutual settlement between the authorities of the two burghs. It is stated that the Board would look favourably on an application by Greenock for a provisional order for a general supply to Port Glasgow, backed by the consent of this burgh, but it was also agreed on the part of the Board officials that, in order to allow the supply to be given immediately to the power users, the simplest way to protect the Greenock Corporation interests would be for Port Glasgow T.C. to give an undertaking that, during the period of 30 years, it would not sanction an application by another authorised undertaker to exercise its powers.

Harrogate.—At the T.C. on the 12th inst., the Electric Lighting Committee recommended that £200 be set aside out of the past year's electricity profits for the development of electric heating and cookery. Alderman Chippendale moved an amendment that the recommendation be deleted. He said there had been a profit of £282 more than was estimated, and he thought the balance should go to the relief of the rates. Mr. J. H. Lofthouse said all progressive electrical undertakings were seriously considering cooking and heating by electricity. In the estimates for the past year £450 was allowed from the electricity undertaking for the relief of the rates. He believed a scheme could be devised, and the Committee wanted the money to carry it out, to earn more money in the future. The amendment was seconded, and on a vote being taken 10 voted for the amendment and 13 for the minutes, which were therefore confirmed.

Heywood.—The Albert New Mill Co. has accepted the terms of the Corporation in connection with a supply of electricity to its mill.

Mr. A. A. Day, manager of the Bolton Electricity and Tramways Department, has written accepting the terms offered by the Corporation for reporting on the general condition of the latter's electricity undertaking.

Horwich.—The Bolton T.C. has applied for the permission of the U.D.C. to supply electricity to a residence being erected in Fall Birch Lane, by Mr. Darbyshire. The Council has decided to ask why previous applications for current from inhabitants of the town have been refused by the Bolton Corporation.

Japan.—The Kinugawa Hydraulic-Electric Co. has just raised a loan of £100,000, with the object of considerably extending its plant.

It is reported from Tokio that negotiations are in hand in connection with the formation of a company to establish an electricity supply station at New Wiju.

Lanark.—On account of the increased demand for current, additions have been made by the County Council to the electric supply station at Cambuslang. In addition to the capacity of the station being doubled and its arrangements modernised, the feeder cables supplying the district have also been doubled.

Leigh.—At a meeting of the T.C. held on the 7th inst., a letter was read from the South Lancs. Tramway Co., in which it made application for the sanction of the Council to the supply of electricity to a local works. It was resolved that the Council be recommended to give its sanction subject to the company entering into an agreement to discontinue such supply on receiving six months' notice from the Council to do so.

Manchester.—Last year the Corporation electricity department generated 124,294,843 units, 93,682,940 units being sold—approximately 64 millions for private purposes and 30 millions for traction. Over 20 million units were used in distribution or otherwise not accounted for, this large amount, however, only representing 16 per cent. of the generated units. The maximum load recorded was 42,000 KW., 10,550 KW. being for traction supply. The total revenue for the year amounted to £436,317, while the gross surplus was £220,422, from which interest, sinking fund and loan repayment, &c., and a transfer to renewals (£21,835), absorbed £192,103, leaving a net surplus of £28,319, as compared with £27,573 in the previous year. The result would have been better but for the coal strike and breakdown of certain economical generating plant which arrested the downward trend of cost of production. The renewals suspense account now amounts to £182,735, and the outstanding mortgage debt to £1,900,000; the reserve fund had dwindled away to nothing, and it is pointed out in the report that the renewals account is considerably below the proper standard.

Newcastle Emlyn.—The U.D.C. has accepted the offer of the E.L. company to light the public lamps and the town clock for £47 per annum, provided the company keeps the lamps in repair.

Newcastle-under-Lyme.—A L.G.B. inquiry was held on Tuesday, last week, into the application of the T.C. for permission to borrow £6,600 for additional generating plant. It is proposed, on the advice of Messrs. Lacey & Sillar, to install two 135-KW. Diesel sets. The proposal is, however, meeting vigorous opposition locally, because it is felt that the installatian of oil engines will deprive the Corporation gas department of its most valuable consumer—engines running on town gas being at present used.

The Committee stated that consideration of figures placed at its disposal by various engineers led to the conclusion that gas would have to be supplied at 5d. per 1,000 cb. ft. in order to compete with the Diesel engine.

New Zealand.—The Government has given an option of license to the Whangarei B.C. to utilise the water-power derivable from the Wairua Falls, in the extreme north of the North Island, for the production of electricity for lighting the borough and for sale to consumers as either light or power. Mr. Vernon Reed, M.P., acting on behalf of a new cement company which has a capital of £170,000, has entered into an agreement with the Council to take from a minimum of 500 H.P. to a maximum of 66 per cent. of the total available power for a period of 25 years. This agreement is of course, subject to the sanction of the ratepayers to the loan necessary to carry out the work.—*Australian Mining Standard.*

The Christchurch City Council has unanimously adopted the provisional agreement arrived at with the Public Works Department respecting the charges to be paid to the Government for power from Lake Coleridge. The Council is to pay £8 13s. 4d. per KW.-year for 300 KW., and £5 per additional KW.-year for all in excess; it also agrees to take a minimum of 500 KW., and the department will guarantee to supply up to 4,500 KW. when required. Notice has, however, been given of a motion to appoint an expert electrical engineer to go through the scheme and report before entering on the expenditure estimated at £100,000.

Norden (near Rochdale).—The U.D.C. has accepted the tender of Mr. John Buttery for the supply of electricity to the new lamps at Red Lumb at 4d. per unit, and decided that an agreement be entered into for five years.

Northampton.—The E.L. and Power Co., Ltd., has reduced the general lighting tariff from 5d. per unit to 4½d., and the alternative sliding scale from 6d. and 3d., to 6d. and 2d. Both are subject to a 5 per cent. cash discount.

Oulton Broad.—The B. of T. has informed the U.D.C. that the latter cannot divest itself of its powers, duties and liabilities under the E.L. order. The Council had asked to be relieved of the liability of carrying out the order, as it could not dispose of it to a private company.

Portrush.—Mr. R. B. Leach, consulting engineer, has been appointed to prepare a report on the scheme for electrically lighting the town, and, in the event of his scheme being accepted, to be engineer to the undertaking from its commencement to its completion.

Radcliffe.—The U.D.C. has applied to the B. of T. for permission to erect overhead lines for the transmission of energy at a pressure of 6,600 volts from the Bury boundary to the Pioneer Mills, and another line from Bolton Road to Countess Lane and Turks Road. In this case the voltage will be 200.

Romford.—The U.D.C. has asked Mr. W. C. C. Hawtayne, Mr. W. T. Pressland and the County of London Electric Supply Co., who are applying for prov. orders for electric supply, for particulars of their schemes for consideration.

Rothesay.—The new electric light installation in the esplanade gardens at Rothesay was recently switched on by the Marchioness of Bute. Energy is supplied to the Corporation by the Rothesay Tramways Co., the total cost being about £650. The installation consists of 2,500 lamps, which produce a very fine effect.

St. Helens.—The extensions to the Corporation electricity supply works have been completed, and the new plant was set in operation by the Mayor, who is also the chairman of the Electricity Committee, on Wednesday, last week. Among the new plant is a 2,000-KW. turbo-alternator, made and installed by Messrs. Dick, Kerr & Co., consisting of a high-pressure impulse-type Bergmann steam turbine, direct-coupled to a three-phase alternator running at 3,000 R.P.M., and generating electricity at a pressure of 6,000 volts, 50 periods. The turbine exhausts into a low-level jet-type condensing plant, the latter maintaining a vacuum of 27½ in., and manufactured and supplied by the Mirrlees-Watson Co. The condensers are fitted with extraction pumps of the centrifugal type and an Edwards three-throw air pump, motor-driven. Extra-H.T. switchgear has been supplied by Messrs. Ferranti, and includes a Brown-Boveri pressure regulator. Boiler house equipment includes a Babcock & Wilcox water-tube boiler of 4,780 sq. ft. heating surface, capable of evaporating continuously 18,000 lb. of water per hour, the boiler being fitted with an underfeed stoker. Coal-handling plant has been installed, consisting of a chain and bucket-type elevator feeding into an overhead bunker, with a capacity of 20 tons. The whole of the boiler house contract has been carried out by Messrs. Babcock & Wilcock. The British Westinghouse Co. is supplying an additional rotary converter of 800-KW. capacity, and when installed it will be possible to generate the greater portion of the current used for tramways, lighting and power with the turbine plant, leaving the reciprocating plant to run on the peak load and for emergencies.

The Higher Education Committee has decided to apply for a loan of £1,000 for the equipment of a mechanical engineering and electrical laboratory at the Gamble Institute.

The Corporation, on the application of the electricity Committee, proposes to ask the L.G.B. for leave to borrow £5,000 spent in excess of the loans for electricity purposes.

Salford.—At the T.C. on the 7th inst. a good deal of discussion ensued on a proposal which foreshadowed an expenditure of £250,000 to £500,000, upon recommendations adopted by the Electricity Committee, as follows:—(*a*) That it is imperative that a new electricity generating station be provided with the least possible delay; (*b*) That a scheme be prepared, including the acquisition of land for a proposed generating station, erection of the requisite plant, provision of cables, and all other matters for the equipment of a new station. It was pointed out that it will be impracticable after the instalment of the two new turbine generators to accommodate further plant in the existing electricity station, and the Electricity Committee's recommendations were passed.

Judging by the remarks made, it is evident that Salford Councillors are not deficient in humour. Thus, Ald. Jackson had seen petrol tramcars running at Morecambe, and naturally concluded that their adoption in Salford would greatly relieve the generating station and thus avoid the costly new scheme proposed. Ald. Phillips, as chairman of the Gas Committee, can be excused for doubting the soundness of the proposed extension scheme. Ald. Hulton, as chairman of the Cleansing Committee, apparently wished to come to the rescue with steam from the refuse destructors—all this, when one prospective new consumer is prepared to guarantee a minimum consumption of 3,000,000 units per annum.

Swansea.—The Board of Guardians' Building Committee has decided to bring up a comprehensive scheme for lighting the workhouse with electricity.

Tipton.—The Shropshire, Worcestershire and Staffs. Electric Power Co. has informed the U.D.C. that it intends applying for a prov. order for electric supply in the district, and also for Smethwick, Oldbury and Rowley Regis.

West Wickham.—The West Kent Electric Co. has informed the Bromley R.D.C. that it intends laying mains from the boundary of Bromley Town to West Wickham, *vid* Hayes.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation Tramway manager, in a report regarding fares, &c., states that, generally speaking, the car fares in the city are much lower than in other towns of similar size, whilst the penny fares give a greater distance than the majority of the largest towns in the country. Submitting the accounts for the past year, Mr. J. A. Smith, convener of the Tramway Committee, said the total revenue was £77,180, an increase of £3,710 over the previous year. Working expenses were £40,969 an increase of £1,294. The surplus for the year was £11,158, an increase of £3,554. With this surplus they had placed £6,762 to the renewal account which had been deficient by this amount, and the remainder, £4,396, was carried forward to a reserve account. Previous to this year they had always had to put the whole of their surplus into the renewal account, but this year for the first time they had more than sufficient money for their renewal account and had been able to start a reserve account. The accounts were adopted.

Ashton-under-Lyne.—A deadlock has arisen between the Ashton Corporation and the Hurst District Council with regard to the renewal of the agreement for the lease to the Corporation of the tramway in the urban district. The expiring agreement has been in operation for 10 years, and under its terms Ashton, it is stated, has lost from £10,000 to £15,000. Ashton now asks that Hurst, under the new agreement, should pay interest, sinking fund, rates, and a fixed sum for renewals. This would represent an increased rate for Hurst of 10d. in the £. The District Council has resolutely refused to accept these terms, and it has threatened that unless better conditions are offered, the tramways in the Hurst area will be closed as from to-day. Hurst is willing to pay the interest and sinking fund equal to a rate of 7½d. in the £. It is possible that the B. of T. will be asked to appoint an arbitrator.

Australia.—The special committee of the South Melbourne City Council has reported unanimously in favour of the permanent tramway, at an estimated cost of £60,000. The Melbourne City Council will be approached and asked to complete the connection (two or three chains) between the South Melbourne boundary and Prince's Bridge.—*Australian Mining Standard.*

The recommendation of the sub-committee of the Melbourne Harbour Trust respecting the inauguration of a tramway service between Spencer Street and the Victoria Dock has been adopted. The alternative schemes are as follows:—(1) Electric tram on rails from Spencer Street to Victoria Dock entrance; (2) electric railless cars; (3) electric omnibus; (4) petrol omnibus. It was also proposed that the Commissioners should have the option of purchasing the entire plant and rolling stock at any date after the expiry of 12 months, plus 10 per cent.

Belfast.—The Postmaster-General has pointed out that the tramway extensions will necessitate considerable alterations to the telegraph wires and poles, and the provision of guard wires at various points, the cost of which would devolve upon the Corporation. The engineer considers that this will cost about £545. A sub-Committee has been appointed to consider the question of a suitable site for the proposed electrical sub-station.

Brazil.—The Rio de Janeiro Tramway, Light and Power Co., Ltd., has recently acquired the tramway system in the suburb of Jacarepagua, which connects with the terminus of the company's Cascadura line. Work is at present in hand in electrifying the newly-acquired system, which has a length of about 11 miles.

Brighton Railway Electrification.—Speaking at the ordinary general meeting of the company, held recently, the chairman mentioned that the electrified services had continued to be emminently satisfactory, and that since the opening of the services in December, 1909, nearly 14 million additional passengers had been carried on the sections electrified. The directors are understood to be giving immediate attention to further extensions.

Burnley.—The T.C. has decided to fall in with the tramway manager's suggestion to fix an additional series of 1½d. fares. The town clerk reported that the extension scheme of the tramway to Harle Syke had been submitted to the B. of T. with a a request that the official inspection should take place as soon after the 12th inst. as possible. It was decided to ask permission from the Board to run a goods wagon attached to the front of the cars travelling on the Harle Syke extension so as to facilitate the conveyance of milk and other goods.

On August 8th there was a satisfactory preliminary run on the Harle Syke extension at Burnley, a couple of cars fitted with the special trucks being run over the lines. All is now ready for the Board of Trade inspection, which was expected to take place some time this week.

Canadian 'Bus Regulations.—In view of the uneasiness created in certain tramway circles by wholesale motor-'bus competition, also the proposals which have been made for curtailing this competition (and which have been generally derided in the daily papers), it is of interest to note that the Montreal City Council has just issued a new by-law, which defines the streets in which the "auto-'bus" shall run, the speed of the vehicles, the fares to be charged, and the frequency of the service. Thus the 'buses are restricted to certain routes, and amongst the other regulations to be observed, they must run all the year round, without interruption, at intervals of not more than five minutes during busy hours and ten minutes at less busy times.

Chile.—The plan for the construction of an electric railway from Santiago to Valparaiso has been approved. The new railway will be completed in ten years' time.

Continental Notes.—Germany.—A hitch has taken place in the proceedings connected with the construction of the prejected express line from Gesundbrunnen to Newköln, which the A.E.G. is to build for the Berlin T.C. The Minister of Public Works has refused to sanction the route planned owing, he contends, to the inconvenience of its traversing certain crossing points of existing and projected underground lines. The crossing in the Konigstrasse offers the greatest difficulty. It is suggested to divert the line towards the east—to the Alexanderplatz neighbourhood. As the contract between the company and the city is signed, the proposed modification of the course will necessitate fresh negotiations between the two parties.—*Elektrotechnisder Nachrichten.*

After lengthy negotiations with the Prussian Government and the authorities of Hamburg, the Alsterbahn Gesellschaft has secured the permission to build its line from Ohlsdorf to a junction with the Hamburg-Ohlsdorf suburban line. The line will be electrically worked, and will serve the beautiful district of the Alster Valley, one side of which river is Prussian and the other side Hamburg territory.—*Elek. u Maschinenbau.*

The final decision as to the electrification of the Berlin Stadtbahn is to be come to by the Landtag in its autumn session. Meanwhile, in order to make as prompt a beginning as possible, preliminary works are being speeded up, so that the conversion may be taken in hand at the beginning of 1913. The more ample material required by the Landtag is partly prepared. The Administration remains of the conviction that the conversion can be no longer delayed.—*Elektrotechnische Nachschrift.*

Turkey.—An understanding has been arrived at between the Smyrna Tramway Co. and the Minister for Public Works for the electrification of the tramways of the city.—*La Lumière Electrique.*

Russia.—A syndicate has been formed in the Russian capital for the extension of the St. Petersburg tramway system. The capital is £3,600,000, and the principals in the operation are the firm of Kolomenski, the Siemens & Halske Co., and the Westinghouse Co.

Switzerland.—The report of the Government Committee of inquiry into the question of the conversion of the Swiss State railways to electric traction states that water powers would be required which would yield from 1,200,000,000 to 1,500,000,000 H.P.-hours on the turbine shafts per annum. A list of the available sources shows that sufficient water-power could be obtained for the purpose without any special difficulties arising. It is estimated that the expenditure on the transformation of the St. Gothard railway would amount to £2,700,000 and the working of the traffic would cost £402,000 per annum and be considerably cheaper than steam locomotion. The system which is considered to be the best for the Swiss railways is the single-phase method at about 15 periods and 15,000 volts.

Italy.—It is understood that the question of introducing electric traction on the St. Gothard lines will not reach the stage of completion before 1914. The administration of the Swiss Federal Railways, before deciding important matters in connection with the work, is awaiting the results of the system of electric traction on the Loetschberg Railway, and this will not commence working until next May.

The Briante Electric Tramway Co., whose headquarters are at Monza, has undertaken the construction of the last stretch of line that goes from Meda to the end of Cantu. It is hoped to inaugurate the new section of the line during next October; several steel bridges have had to be constructed in connection with the work. The total cost of the work is estimated at 700,000 liras (£28,000).

France.—According to the *Morning Post*, the first of the single-coach electric trains to run between the Invalides Station, Paris, and Versailles, has been tested, a speed of 53 miles an hour being obtained. Eight similar one-coach trains are to be provided.

Belgium.—Good progress is being made with the establishment of the electric tramway system in the town of Louvain; all the lines—which have a length of about eight miles—are now laid, and one route has just been opened for traffic. The necessary electrical energy is being supplied from the generating station of the Société de l'Electricité du Nord de la Belgique.

Norway.—It is reported from Bergen that there has recently been held a meeting for the discussion of the building of an electrically-driven cable railway from the town to the top of Flöifjeldet, which is a mountain situated on the northern side of the town. The railway will run partly through a tunnel and partly in the air. In connection with this project, it is also intended to build a hotel for the tourists on the mountain. The total capital expenditure for both projects is estimated at about £40,000 to be divided equally between them. The plans and estimates have been laid before the directors of the Tourist Association, who have approved of them, and an application for the Government concession is going to be submitted in the near future.

Falkirk.—At an extraordinary general meeting of the Falkirk Electric Construction Syndicate at Larbert, it was decided not to increase the capital for carrying out the tramway extension scheme from Falkirk to Grangemouth.

Farnworth.—The local D.C. is co-operating with the Little Hulton D.C. in trying to persuade the South Lancashire Tramways Co. to construct tramways from Little Hulton to Farnworth.

Glasgow.—Bailie Pratt has given notice of the following motion to be moved at the next meeting of the Tramways Committee:—"That it be remitted to a special sub-committee to consider and report as to the desirability and practicability of the tramways department providing cottage dwellings to be rented by workmen in the service of the department."

It has been decided by the Corporation Tramways Committee to recommend to the T.C., without prejudice, that, as from December 10th last (the date when the extended halfpenny stage came into operation) the annual premium payable under the Corporation's third-party insurance policy with the Excess Insurance Co. be increased by 12½ per cent. in lieu of 10 per cent., as recommended earlier.

In connection with the celebrations of the centenary of the first call at Glasgow of the steamship *Comet*—the progenitor of steamship navigation—the Corporation decided that specially decorated cars should traverse the principal tramway routes of the city. Contracts for the decorations have now been fixed, the successful offerers being Messrs. Wylie and Lockhead, and Mr. Claude Hamilton.

London-Southend Electrification.—The Purchase Bill for the Southend line was referred to at the half-yearly meeting of the Midland Co., when it was indicated that the directors were satisfied that to develop the line properly it would have to be electrified, and that money spent for that would be profitably spent.

Middlesex.—The figures contained in the fifth annual report of the Light Railways Committee of the Middlesex C.C., just issued, are indicative of very substantial progress; 57 miles of tramways are in use (which are leased to and worked by the Metropolitan Electric Tramways, Ltd.), and the County Council, under the terms of the lease, takes 45 per cent. of the profits, its share this year amounting to £3,765. Traffic receipts totalled £460,500, an increase of some £67,000 on the previous year, but the average earnings per car-mile, 10½d., were a little lower. As a set-off, however, there was a slight decrease in the working expenses per car-mile, the profits approximating 3½d. per car-mile. The Council's loan debt to March 31st, 1912 (less discount on and expenses of the issue of County stock), amounted to £1,939,544; 90 millions of passengers were carried, being an increase of over 23 millions.

Oldham.—The question of ½d. tramway fares was discussed by the T.C. recently. Councillor Dunkerley said that the system had been adopted in Manchester, Glasgow and other places, but it would not suit Oldham owing to the short stages into which the routes were divided up. The Council confirmed the decision of the Tramways Committee not to introduce ½d. fares.

Salford.—During the past year there have been nearly 49 million passengers carried on the Corporation cars, and nearly 6 million car-miles were covered. The receipts were £253,315, the average receipts being 10·46d. per mile, or nearly ½d. more than the earnings in 1903, when the average was 10·25d. There was a gross profit of £97,813, which added to £5,157 from investments, made an available balance of £102,971. This has been absorbed by the payment of £29,425 to local authorities for running powers, &c., £45,816 to interest and sinking fund, £9,509 to depreciation and renewals fund, and £160 for repairs. A sum of £18,000 was contribnted to the relief of the rates, and is £8,000 more than was contributed to the rates in 1903. The stock of cars at the end of the year was 200, and there are 75 miles of lines worked by the Corporation, 25 miles being leased and 40¼ owned outright by the Corporation; 2¼ are worked jointly with Manchester Corporation, and on the remaining nine running powers are possessed.

South Shields.—A long discussion took place at the last meeting of the T.C. on the question of extending the tramways to Horton village. The Tramway Committee recommended that the motion be postponed for 12 months, but Mr. Anderson, vice-chairman of the Tramways Committee, proposed that the Committee be instructed to take steps to obtain the necessary powers for carrying the tramways to Horton, and that the proposal be submitted to the rural authorities. The amendment was rejected on a vote

South-Western Railway Electrification.—At the recent half-yearly meeting of the South-Western Co., the chairman said that the electrification of the suburban lines had been receiving attention, and the necessary plans and estimates were being prepared. They had called in Sir Alexander Kennedy to advise, but the matter was not ready yet to place before the shareholders. They were satisfied the proposal was one they would be able to confidently place before the shareholders in the near future. The scheme being worked out contemplated such a service of trains to all the principal towns in the Thames Valley as would give entire satisfaction and leave no room for a competing line.

U.S.A.—A recent issue of *The Motor* contains statistics of the motor-car industry in the States. It appears that including certain States where figures were estimated, the total registrations were 860,000 approximately. During the year ending June 30th, 1912, there were 252,569 motor-cars produced in the States, and this included 6,000 electric pleasure cars and 1,000 electric commercial cars.

It is reported that the Banker's Express from Boston, hauled by a 90-ton electric locomotive, left the track in the centre of the tunnel leading into New York city. According to our account the live-rail was broken and much violent arcing occurred before the train was brought to a standstill, one luggage van catching fire and burning. The passengers were rescued through an opening in the tunnel roof.

West Hartlepool.—A special meeting of the T.C. was held on the 9th inst. to consider a report of the Tramways Committee recommending the acquisition by the Corporation of that portion of the West Hartlepool and Hartlepool route, which is in the former borough, and of the Seaton-Carew section, which were constructed under the West Hartlepool Light Railway Order of 1897. The Committee reported that no applications had been received in response to the advertisements for the leasing and working of the tramways. The Committee also recommended that such of the tramway staff as had applied to be taken over on the same terms and conditions as their appointments under the company, be taken over by the Corporation. It was further recommended that the Tramway Co. be asked to submit terms for the sale of that portion of the West Hartlepool and Hartlepool route as lies within the borough of Harlepool, and the Corporation of that borough be asked whether it concurs in such a sale. The report was adopted.

TELEGRAPH and TELEPHONE NOTES.

American Wireless.—According to a lengthy statement in the *Financial Times* of the 13th inst., the final papers were signed on the 3rd ult., by which the physical assets and patents of the United Wireless Telegraph Co., of U.S.A., were turned over to the Reorganisation Committee appointed in connection with that company's affairs, and they have since been sold to the Marconi Wireless Telegraph Co., of America, for 140,000 $5 shares of that undertaking.

Australia.—In connection with the wireless telegraph station recently set up for the Commonwealth Government, the Australasian Wireless Co, states that tests have been going on for several weeks, and that they have proved more than satisfactory. With 70 H.P., the wireless plant has not only succeeded in establishing communication with stations or ships 1,250 miles distant, but has established communication at 2,920 miles. It is considered quite probable that communication may be established at night time between Sydney and San Francisco—a distance of about 6,000 miles.

Compulsory Wireless on Ships.—In connection with the recommendations as to wireless equipments on British ships, arising out of the *Titantic* inquiry, the *Financial News* says the Governments of Canada, the United States, New Zealand, and Italy, have for some time insisted upon the equipment, and on August 1st last all Spanish merchant vessels carrying passengers or mails had to be fitted with the apparatus, while from January 1st next no passenger will be allowed to embark at Spanish ports on any ship which is not similarly provided. A compulsory regulation has come into force in Uruguay, and all ships not complying with it will be refused dispatch. Then on October 1st a German law on the subject also takes effect, and involves vessels which have 75 people on board, including crew, as well as cargo boats carrying at least 60 persons, though steamers trading in the North Sea, the Baltic, the Mediterranean, and the Black Sea, are exempted.

German Cable Subsidy.—It was stated at the recent meeting of the German South American Telegraph Co. that the Imperial Post Office had decided to grant an annual subsidy of £42,500 for the proposed cable extension from Teneriffe to Duala, in the Cameroons. The subsidy is for a period of 40 years, and is to be increased to £45,750, on the introduction of duplex working.

Germany.—A new company has just been formed in Berlin, with a capital of £65,000, and the title the A.G. Deutsche Sudsee Gesellschaft für Drahtlose Telegraphie, to link up the German Colonial Possessions in Oceana by means of wireless telegraphy with the telegraph stations of the Deutsch-Niederlandische Telegraphen Gesellschaft.

Liberian Wireless Developments.—In Monrovia, the capital of the negro republic of Liberia, two wireless stations have lately been opened to public traffic. One of the stations belongs to the French West Africa Telegraph Administration, and the other to the Deutsch-Südamerikanische Telegraphgesellschaft, of Cologne, and is an annex to their telegraph station there. The latter station is concerned only with the exchange of telegrams with ships at sea, whereas the French station, in addition, exchanges communications with the existing, and will later on with the projected stations in the neighbouring French possessions.—*Zeit für Schwachstromteknik.*

Marconi v. Fessenden.—The Marconi Co. informs us that it has received a Marconigram from its patent lawyers in New York advising that the Examiner of Interferences has awarded all priority to Mr. Marconi, disallowing the claims of Fessenden, in respect of synchronously operated spark-gaps.

Post Office Engineers.—In the *London Gazette* of July 30th, the Civil Service Commissioners published the regulations respecting open competitive examinations for the situation of assistant engineer in the Engineer-in-Chief's Department of the General Post Office. The limits of age for this situation are 21 and 24. Candidates must satisfy the Commissioners that they have had at least two years training in an engineering works or an engineering school, or partly in a works and partly in a school, and must pass an examination, which is open to all British subjects, with certain restrictions. A fee of £3 is charged for admission to the examination.

Proposed Atlantic Weather Bureau.—Prof. Moore, head of the Meteorological Office, Washington, proposes that a median line shall be established through the North Atlantic, and all ships fitted with wireless apparatus, sailing on either side of it, will be required to take a daily weather observation. The idea is that vessels on the eastward half of the ocean should relay these reports to London and Paris, and those westward of the line to Washington. By a close comparison of the messages it will be possible to estimate the track and speed of storms, to make up a weather chart for cabling to each side of the Atlantic every day, and to warn navigators when special precautions are necessary.

Russia.—It is intended to erect a second telephone line between St. Petersburg and Moscow. The new line will be a double one, and its cost is estimated at about £21,100.—*Der Elektrotechniker.*

Spanish Telegraph Statistics.—The telegraphic network of Spain in 1910, according to statistics just published, had an extent of 42,934,974 km., 87 stations with a continuous service were in existence, 341 with a day service, and 1,474 stations with a limited and special service. The number of instruments in use was 1,884, of which 1,440 were Morse, 249 Hughes, and 195 of other types. The receipts of the interior service totalled 8,192,853 pesetas, and of the international service 3,484,384 pesetas. Telephone receipts totalled 1,142,448 pesetas. The cities of Madrid, Barcelona, Valencia and Corunna, in the order named, were the chief clients. In the previous five years, the network increased by 12,988,213 km. of lines, the stations by 193, the instruments by 234, and the receipts from both telegraphs and telephones by 1,733,420 pesetas.—*Elektron.*

Submarine Signalling.—The *Daily News* states that there are now 122 submarine signal stations in use or being installed, and that nearly 900 ships are equipped with the Submarine Signal Co.'s receiving apparatus.

Telephony in Japan.—Telephonic communication has recently been established between the summit of the well-known mountain Fuji and Gotemba and Omiya.

The Bergen Wireless Station.—This station has been opened to public use. It is one of the most powerful stations in Europe, its range extending as far as the North Cape and over the North Sea as far as Iceland and the Atlantic Ocean.—*Zeit für Schwachstromteknik.*

Trunk Telephone Rates.—The P.M.G. recently intimated in a Parliamentary reply to Mr. Fiennes, that he had been able to arrange for the use of telephone trunk lines during the less busy hours of the day under monthly contracts for daily periods of 15 minutes or more, on payment at the following rates:—

For the first or second quarter-hour period, three-quarters of the ordinary rates, according to the time occupied.

For the third and fourth quarter-hour periods, one-half of the ordinary rates.

For each additional quarter-hour period, one quarter of the ordinary rates.

The time for which such arrangements can be made necessarily depends upon the demands of the ordinary trunk service, but as a rule special contracts can be accepted for the use of lines before 9 or 9.30 a.m., between 1 and 2 p.m., and after 4.30 or 5 p.m.

For long periods, of not less than six hours between 5 p.m. and 6 a.m., still more favourable rates of charge are in force, based on the actual length of the line used. The rates are as follows:—

For six hours' use, £2 10s. per mile per annum; and for twelve hours' use, £3 10s. per mile per annum.

For periods of between six and twelve hours the charge is as for six hours, with an addition of 5s. per mile per annum up to a maximum of £3 10s.

Wireless Stations in Panama.—The United States Government intend to expend $1,000,000 in constructing wireless stations on the Isthmus of Panama. An arrangement has been entered into with the Government of Panama whereby all private companies are precluded from erecting wireless stations in Panama.—*Zeit. fur Schwachstromteknik.*

Wireless Telegraphy.—A wireless connection right across South America has been established by the Telefunken Co. between Lima, on the West Coast, and Para, on the East. The distance is 2,100 miles over primeval forests and the transmission bridges over the high Andes. Messages dispatched from Lima proceed direct to Manaos, on the Amazon River, and thence to Para.

The Compagnie Générale Radiotélégraphique has received the order to equip the whole of the fleet of the Compagnie Sub-Atlantique with wireless plant. Eight steamers will be fitted on the "musical spark" system.—*Journal des Postes.*

Wireless telegraph experiments are being carried out by the Western Telegraph Engineers of the West Lancs. Division of Territorials at the top of Blackpool Tower, the first military station to be constructed upon the top of a tower in this country, and they have been attended with gratifying success. Capt. Coulston, R.F.A., is in command of the wireless company.

The tests that the Colombo wireless station has been undergoing for some time have been completed, and have proved very satisfactory. The record for the longest distance wireless messages ever sent in the East was created by the Colombo station last week, when they spoke to Sabang, Sumatra, 1,007 miles away.—*Indian Engineering.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—New South Wales.—August 28th. Common-battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" July 26th.

September 25th.—Trunk line switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

October 2nd.—N.S.W. Government Railways. Six 1,000-kw. sub-station units to specification No. 357. Specification (10s.) from Electrical Engineer's Office, 61, Hunter Street, Sydney.

October 16th.—N.S.W. Government Railways. Two 5-ton electrically-driven travelling cranes, for the Randwick workshops. Specification No. 365 (5s.). Electrical Engineer's Office, as above.

South Australia.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" to-day.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" to-day.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria.—October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

September 3rd.—Six 60-k.v.a. transformers, for the Melbourne City Council. See "Official Notices" to-day.

Melbourne.—September 17th. One fuel economiser, for the Corporation electricity works.

October 2nd.—Two vertical sets of electrically-driven rotary pumps, for the Melbourne City Council. See "Official Notices" to-day.

Western Australia.—November 5th. One common-battery automatic switchboard, one common-battery semi-automatic switchboard, one common-battery manual switchboard and equipment, for the P.M.G.'s department, Perth.

Austria.—Vienna.—November 30th. Plans are required for the erection and operation of an electrically-worked municipal central clock installation. Particulars, Magistratabteilung V, Vienna.

Batley.—August 23rd. High-tension cables, for the Corporation. See "Official Notices" August 2nd.

Bedwas.—September 5th. Electrical goods for a year for the Bedwas Navigation Colliery Co., Ltd. (Form 4). The Secretary.

Belgium.—September 3rd. The Société Nationale des Chemins de Fer, of Brussels (14, Rue de la Science), is inviting tenders for (1) the supply and installation of the electrical equipment of a transformer sub-station at Dieghem, in connection with the Brussels-Haecht light electric railway; (2) the supply of the copper rail bonds required by the company during the year ending October 1st, 1913; and (3) the supply of the bronze wire required for overhead conductors during the same period. The bronze wire required is round in section, and 53, 64 and 80·2 mm. in diameter.

Bradford.—August 28th. One 300-kw. and one 1,500-kw. rotary converter, for the Corporation. See "Official Notices" to-day.

Costa Rica.—December 9th. Tenders will be received for the building and working of an electric tramway between Alajuela and Grecia, a distance of 18,100 m. Particulars from the Secretaria de Fomento, San José.

France.—October 8th. The French State Railway authorities in Paris are inviting tenders for the supply of the current necessary for the electrical operation of the State railway system in the Paris district. Particulars may be obtained from, and tenders are to be sent to, Le Directeur des Chemins de Fer de l'Etat, 20, Rue de Rome, Paris.

Hungary.—Beszterczebanya.—August 24th. Tenders are invited for the supply of a 500-h.p. crude-oil engine with accessories, a three-phase generator and a switchboard with connections. Deposit 5 per cent. Particulars (5 kronen), Ingenieur Tibor Szeberenyi, Josef-utea 12, Budapest VIII.

The municipal authorities of Varpalota have just invited tenders for the concession for the establishment and working of a central electric lighting station in the town during a period of 50 years.

Leeds.—September 9th. Paper-insulated cables, for one, two or three years, for the City electric lighting department. See "Official Notices" August 9th.

London.—L.C.C.—August 23rd. Electric lighting, bells and telephones at the County Secondary School, Plumstead, S.E. See "Official Notices" August 9th.

Lewisham.—The Infirmary Committee of the Guardians have decided to obtain tenders for the installation of electric light in the operating room.

Manchester.—September 10th. One 12,000-kw. three-phase high-pressure turbo-alternator, with condensing plant, &c., water-tube boilers and superheaters, economisers and coal chutes, for the Corporation. See "Official Notices" August 9th.

August 28th.—Electric lighting fittings at Atherton Street Schools, Deansgate, for the Education Committee. The Offices, Deansgate. (Returnable deposit £1 1s.)

New Zealand.—September 5th. 100 prepayment "shilling-in-the-slot" wattmeters, for the Wellington Corporation electric lighting department. A copy of specification may be seen at the Board of Trade Commercial Intelligence Department, London, E.C.

Rochdale.—August 28th. The Electricity Department is inviting tenders for 50,000 tons of best coal. T. Banbury Ball, Gas and Electricity Works, Dane Street, Rochdale.

Rosario.—October 15th and September 21st. According to the *Review of the River Plate*, the Municipality is calling for tenders, until October 15th, for a second system of electric tramways, including their construction and working. Full particulars from the Municipality. Tenders for the public electric lighting will be opened on September 21st.

Roumania.—August 20th. The municipal authorities of Turgu-Ocna (Bacau) are inviting tenders for the establishment of a central electric lighting station in the town.

The municipal authorities of Botoshani are about to invite tenders for the concession for the supply of electrical energy for lighting and power purposes in the town.

South Africa.—September 11th. Durban Corporation. One-ton electric storage battery vehicle. A statement on the matter can be seen at the Board of Trade C.I. Department, London, E.C.

Spain.—September 1st. The municipal authorities of Algeciras are inviting tenders for the concession for the electric lighting of the town. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Algeciras.

Torquay.—September 2nd. One 1,000-kw. single-phase turbo-alternator, condensing plant and switchgear, for the T.C. See "Official Notices" to-day.

Witney.—The U.D.C. is inviting tenders for (*a*) suction gas plant and accessories, including vertical high-speed 75-kw. engine and d.c. dynamo; (*b*) battery booster; (*c*) switchboard; (*d*) cables. Specifications, &c., from May & Hawes, consulting engineers, Caxton House, S.W. Deposit £1 1s., returnable.

CLOSED.

Atherton.—The U.D.C. has accepted the tender of the British Westinghouse Co., Ltd., for one 250-K.V.A. transformer.

Australia.—The following contracts have recently been placed, according to the *Australian Mining Standard*:—

SOUTH AUSTRALIA.—Supply and Tender Board.—

1¾ miles telephone cable for £307.—Todd & Samuel.

SYDNEY.—Postmaster-General's department.—

Various distributing boxes, &c.—Western Electric Co. (Australia), Ltd.
4,500 cable clamps, each pattern "A" and "B."—Boehme & Owen.
17,850 ft. piping, wrought-iron, galvanised, £819.—T. McPherson & Son.

ADELAIDE.—Postmaster-General's department.—

Two switchboards, magneto wall pattern, 25 lines, at £12 16s. 3d. each; two switchboards, magneto, non-multiple, 50 lines, at £26 each; three switchboards, magneto, non-multiple, 100 lines, at £37 each.—J. Bartram & Son Pty, Ltd.

BRISBANE.—Postmaster-General's department.—

Four drums, each 1,000 ft. of lead-covered cable, £70.—W. T. Henley's Telegraph Works Co., Ltd.

MELBOURNE.—Postmaster-General's department.—

10,000 glazed earthenware conduits, 6-ducts, at 2s. 10d. each, £1,417; 5,000 glazed earthenware conduits, 4-ducts, at 1s. 10d. each, £458.—Hoffman Patent Steam Brick Co., Ltd.
500 three-position switching keys at 6s. 3d. each, £156; 3,000 condensers, 2-microfarad, at 1s. 9d. each, £262.—J. Bartram & Son Pty., Ltd.
120 miles tinned copper wire, rubber-insulated, cotton-covered, at £2 per mile, £240; 400 common battery wall telephones, at 35s. 9d. each, £715.—British General Electric Co., Ltd.
1,500 glazed earthenware conduits, 4-ducts, at 1s. 10d. each, £137.—Hoffman Patent Steam Brick Co., Ltd.

BRISBANE.—Postmaster-General's department.—

5 tons wire, galvanised steel, 3-strands, No. 16 S.W.G., at £20 per ton.—Noyes Bros. (Sydney), Ltd.

SYDNEY.—Postmaster-General's department.—

36 tons bolts at £18 15s.—T. McPherson & Son.

The *Australian Mining and Engineering Review* states that the tender of the British Aluminium Co., Ltd. at £340, has been accepted for 3 tons, 12 cwt. of bare hard-drawn aluminium cables by the Melbourne City Council.

The Sydney Council has ordered fibre conduit (£479), an electric pulley block (£162), and underground cables (£5,404) from Noyes Bros. (Sydney), Ltd.; also underground cables (£785) from B. I. and Helsby Cables, Ltd.; underground cables (£2,042) from W. T. Henley's Co., and underground cables from the Western Electric Co., Ltd., at £560.

Barrow-in-Furness.—The T.C. has accepted the tender of Messrs. Wm. Gradwell & Co., Ltd., for extensions to the Electricity Works buildings, at £983.

Bootle.—Further tenders as follows have been accepted by the Corporation in connection with the erection of the new electricity supply works in Marsh Lane and Hawthorne Road:—

Babcock & Wilcox, Ltd.—Steam piping, £155.
J. Smith, Ltd.—Overhead cranes, £310.
Kennicott Water Softener Co.—Water-softening plant, £300.
W. and T. Avery, Ltd.—A weighbridge with 16 ft. × 8 ft. plate, £78.
Mellows & Co.—For glazing the roofs of the engine house and boiler-house, £575.

Glasgow.—The Tramways Committee recommends the T.C.'s acceptance of the following:—

Armature coils	Malleable Steel Castings Co.
Special track work	Lorain Steel Co.
Rails and fishplates	Lorain Steel Co.
Copper strip	Chas. Henderson & Co.

Hereford.—The T.C. has accepted the tender of Messrs. Wm. Cory & Co., Ltd., for 2,000 tons of best Cannock rough small coal for the electricity works, at 11s. per ton.

London.—Mr. F. R. Garrod, of Golder's Green, N.W., has obtained the contract for electric lighting, power, signs, &c., at the new Arcade, 78, Uxbridge Road, W., for the British Arcades, Ltd., "Funland," of Edgware Road.

Salford.—The T.C. has accepted the following tenders:—

Sharples, Hill & Co.—Alteration to electric light at Royal Technical Institute, £34.
H. J. Mabbs.—Motor starters, £400.
W. Hodgson & Sons, Manchester.—20-ton weighbridge for coal-conveying plant, £82.

Sheffield.—The tender of the British Electric Transformer Co., Ltd., has been accepted by the T.C. for a biennial supply of transformers and switchgear. The tender of Abbott & Bannister, at £6,750, has further been accepted for carrying out extensions at the Neepsend power house.

Walsall.—The T.C. has accepted the tender of the General Electric Co., Ltd., in lieu of that of the British Westinghouse Co., Ltd., at £198, for the supply of a new switchboard.

Wigan.—The Tramways Committee has accepted the tender of Messrs. Webster & Winstanley, at £2,640, for the supply of British Standard No. 3 steel rails to the Sandberg Silicon process for tramway loops.

NOTES.

A Minister of Commerce.—For some years past there has been a strong feeling in commercial circles that a Minister of Commerce should be appointed. The matter has been referred to in these columns from time to time. It is now understood that the Prime Minister has asked the Association of Chambers of Commerce of the United Kingdom to embody its proposals in a memorial to be presented to him. The Association, it is stated, has asked Sir. F. F. Adam, a member of the Commercial Intelligence Committee of the Board of Trade, to draft the memorial.

Will.—According to a Swansea paper, the late Mr. S. Mansel Jones, electrical engineer, who died in May last, left estate of the gross value of £1,435, with net personalty sworn at £27.

Australian Factories.—A Reuter dispatch from Melbourne, appearing in the *Birmingham Daily Post*, says that the Victorian statistics report for 1911 shows that the number of factories in the State of Victoria is 5,126, employing an aggregate of 113,000 hands, compared with 4,873 factories in the preceding year, employing 102,000 hands. Male employés constitute 65·7 per cent. of the total number. Their wages amounted to £7,358,000 during the year, females receiving £1,553,000, making a yearly average of £106 12s. 4d. and £41 3s. 3d. for men and women respectively. Wages constituted 21·4 per cent. of the value of the output.

Fatality.—According to a Glasgow paper, Edward Kerr, labourer, Buchanan Street, Coatbridge, while engaged at an electric crane within the British Tube Works, received an electric shock, and death was instantaneous.

Athletics.—The London Electric Railways Institute and Athletic Association, which has a membership of 750, held its first annual sports on Saturday, August 3rd, at the Paddock, North End Road, Hampstead.

Educational Note.—UNIVERSITY COLLEGE.—We have received a copy of the "Handbook of the Faculty of Engineering," at the University College, Gower Street, for the forthcoming session. Dr. J. A. Fleming, the Dean, is head of the Electrical Engineering Department, with Mr. W. C. Clinton, B.Sc., as assistant professor, Mr. E. Kilburn Scott as lecturer, and Mr. G. B. Dyke, B.Sc., as assistant. The first term of the session opens on September 30th. Intending students should communicate with the Provost (T. Gregory Foster, Ph.D.), at the College, as early as possible.

Concealed Lighting at St. Mary's Church, Warwick.—St. Mary's Church, Warwick, is a very fine old building in the perpendicular style, of which only the sanctuary and chancel are at present equipped with the electric light. The installation, which was carried out by Mr. Alexander Wylie, Warwick, to the design and specification of the British Thomson-Houston Co., is on the concealed lighting system. Batteries of reflectors—some Mazdalux and some prismatic glass—are attached to the east side of projections, such as the pillars supporting the chancel arch, and the side of the window recesses. Each battery of reflectors (there are four in the choir stalls and four in the sanctuary, containing in all 30 Mazda lamps) is so disposed as to concentrate the light in the required direction. The length of the chancel is 73 ft., and the 30 Mazda lamps give an approximately uniform horizontal illumination of 2 foot-candles. This method of lighting gives uniform horizontal illumination—it renders visible the beautiful roof tracery—and no fittings can be seen by the congregation. The installation was designed by the B.T.-H. Co.'s illuminating engineering department.

Centre of Area.—An American correspondent writes as follows:—For good working a power station should be located at the centre of the area and the feeding points as near as possible to the centre of their respective local areas. We know that physical conditions seldom allow of such ideal happenings, but when necessary, a novel way to find the centre of the area is to outline the district on a piece of paper, then go over the outline with water using a small brush for the purpose. Now fill up the area with water and float the paper on a bowl of water, the water area should be filled up by squeezing a small wet rag on it until the area is as deep as possible without the water running out of bounds. When all is prepared fix a pin with the point dipping into the water, that is, on the paper, but not touching the paper; no matter where you put the point of the pin the paper will shift around until the centre of area locates itself right under the pin point.

The Extraction of Nitrogen.—The representatives of certain Canadian and Spanish interests have recently been in negotiation at Christiania with the Hydro-Elektriske Aktieselskab, which owns the large nitrate works at Notodden, in regard to the establishment of branch factories in Canada and Spain. It is said that the negotiations have led to the decision to erect works in the vicinity of Montreal and Barcelona to produce according to the Eyde-Birkeland process, and the Norwegian company will have a financial interest in the undertakings.

Plant Wanted for Calgary.—It is stated in yesterday's *Standard* that Mr. A. G. Graves, the City Commissioner of Calgary, Alberta, will visit London during the early part of September. "During his stay he is anxious to get into touch with the manufacturers of large-unit gas engines to be used for electric light generating purposes and power by gas, as there is a possibility of the City of Calgary adopting this type of power if it be proved beneficial." His address will be care of High Commissioner for Canada, 17, Victoria Street, London, S.W.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with th technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. J. P. KEMP, the resident engineer of the Summer Lane Station, who is resigning his appointment at the end of this month to take up the post of chief engineer of the Para Electric Railways and Lighting Co., Ltd., was entertained by the staff and workmen of the Birmingham Corporation Electric Supply Department at the White Horse Hotel, Birmingham, on Monday, August 12th, and was presented with an illuminated copy of a resolution of congratulation passed by the Birmingham Electric Supply Committee, a gold cigarette case, suitably incribed, from the staff and workmen of the whole department, and a silver cigarette case, subscribed for by the workmen of the Social Club. Mr. Kemp was also handed a jewelled pendant for Mrs. Kemp. Mr. Chattock, who made the presentation, called attention to the fact that Mr. Kemp had been resident engineer at Summer Lane Station since its opening, and that the great developments which had taken place in the 6½ years had raised the capacity of the station from 11,500 to 26,500 KW. On behalf of the whole staff, he congratulated Mr. Kemp on the appointment he had obtained, and wished him success and happiness in his new and responsible position. Mr. Kemp suitably replied.

MR. G. PARR, assistant accountant, in connection with the Marylebone electricity supply undertaking, and MR. A. MCKICHAN, consumers' accounts clerk, left on Saturday last, by the *Kingfauns Castle*, for South Africa, to take up appointments with the Victoria Falls and Transvaal Power Co., Ltd. On the Thursday previous to their departure, Mr. Parr was presented by his colleagues with a pair of binoculars, an attaché case, and a cheque, and Mr. McKichan with a gold watch, suitably inscribed, the presentations being made by Mr. E. J. Jennings, secretary and accountant of the department.

The *Australian Mining and Engineering Review* states that MR. A. T. TWISS, recently associated with Siemens Bros. Dynamo Works, Ltd., in Victoria, has been appointed electrical engineer to the Zeehan municipal electric supply.

The Horsham U.D.C. have appointed MR. CHUBB, second assistant engineer, as chief assistant engineer at the electricity works, his salary being increased to £120 per annum. MR. ERIC SENDALL has been appointed second assistant engineer.

Tramway Officials.—At a meeting of the West Hartlepool Corporation on the 13th inst., MR. C. BURGESS, of Wigan, was appointed tramways manager at a salary of £200 per annum. There were 52 applicants for the position.

General.—A fortnight ago we published a paragraph in this column, on the authority of one of our usual provincial news correspondents, stating that MR. JOHN HESKETH, of Australia, had been as recently as that week paying a visit to Blackpool, where he was years ago borough electrical engineer. As a matter of fact, however, Mr. Hesketh was at that time on the seas on his return to the scenes of his Australian activities. From the *Australian Mining Standard* received by this week's mail, it appears that he was expected back in Melbourne in the third week of last month. We have investigated the matter at Blackpool, and find that information to the same effect as was passed on by our correspondent appeared in a Blackpool newspaper on July 26th—a week later than Mr. Hesketh's arrival in Australia! It remains for us to do one of two things—either to congratulate Mr. Hesketh on his supernatural powers, which on occasion must be extremely convenient to a busy Government official, or to wonder how the report gained such belated currency at Blackpool. Reluctantly we must, we suppose, choose the latter alternative.

We are sure that a very large number of our readers, and especially those associated with electricity supply affairs, will join with us in an expression of deep sympathy with MR. E. CUNLIFFE OWEN, secretary of the Metropolitan Electric Supply Co., on the death of his elder son, Francis Edward, which has just occurred, at the age of 27 years, after an illness extending over some two years, and accompanied by intense suffering.

MR. G. D. SEATON has joined the staff of Messrs. Richardsons, Westgarth & Co., Ltd., and will represent them in the Manchester district, where he will act as sales agent for their land specialities.

Indian Engineering states that with the departure of Mr. T. Roberts, telegraph superintendent, on leave home preparatory to retirement, the Madras and Southern Mahratta Railway Co. have, it is believed, centralised the executive control of the telegraph department under Mr. H. H. L. Prendergast, their electrical engineer at Arkonam, with Mr. R. C. C. Yates, as first assistant electrical engineer at a salary of Rs. 500-700 per mensem. The electrical department has been strengthened by the recent appointment from home of an assistant electrical engineer.

On 15th inst., at Cornhill, Biggar, the marriage was solemnised of MR. JAMES CALDWELL, M.I.E.E., eldest son of Thomas Caldwell, Rockfield, Paisley, to Blanche, youngest daughter of Mr. James Young, J.P., Cornhill, Biggar.

Obituary.—The death has occurred at Capstones, New Mills, of MR. F. BURKS, managing director of the High Peak Electric Works, New Mills. He was 54 years of age.

NEW COMPANIES REGISTERED.

South American Railless Traction Co., Ltd. (123,567).—This company was registered on August 1st, with a capital of £2,000 in 1,800 preferred shares of £1 each and 4,000 ordinary shares of 1s. each, to carry on in South America or elsewhere the business of engineers, electricians, suppliers of electricity and gas for light, heat or motive power, manufacturers of locomotives, engines, rolling stock and conveyances, cables, wires, lines, accumulators and works, whether for railway, tramway, road, field or other traffic or purposes, and rails and railway and tramway plant and apparatus, &c. The subscribers (with one share each) are:—F. Jackson, Hurstbourne, Elgin Road, Croydon, clerk; H. Boger, 74, Compayne Gardens, West Hampstead, N.W., clerk. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration as fixed by the company. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

British Electric Equipment Co., Ltd. (123,576).—This company was registered on August 2nd, with a capital of £3,000 in £1 shares, to carry on the business of mining and electrical engineers, electricians, suppliers of electricity, &c., and to adopt an agreement with M. M. Gillespie and M. Beales. The subscribers are:—M. M. Gillespie, Amberley House, Norfolk Street, W.C., engineer, 100 shares; M. Beales, Amberley House, Norfolk Street, W.C., engineer, 100 shares; E. H. Wiley, 30, Duke Street, St. James', S.W., solicitor, one share. Private company. The number of directors is not to be less than two or more than five; the first are M. M. Gillespie (chairman) and M. Beales; qualification, £100. Registered office, Amberley House, Norfolk Street, W.C.

Kerswell, Faulkner & Hamlyn, Ltd. (123,636).—This company was registered on August 7th, with a capital of £6,000 in £1 shares, to carry on the business of manufacturers of electric fittings and appliances, metal workers, tool makers, founders, machinists, mechanical and electrical engineers, iron and steel converters and smiths, &c., and to adopt an agreement with H. H. Kerswell and S. W. Hamlyn. The subscribers (with 667 shares each) are:—H. H. Kerswell, 6, Adelaide Road, South Hampstead, manufacturer; J. H. Faulkner, 31, Langland Gardens, Hampstead, N.W., salesman; S. W. Hamlyn, 85, Parchmore Road, Thornton Heath, manufacturer. Private company. The number of directors is not to be less than two or more than three; the first are H. H. Kerswell, J. H. Faulkner and S. W. Hamlyn (all permanent); qualification, £500; remuneration as fixed by the company. Registered office, Hanway Street Works, Hanway Street, Tottenham Court Road, W.

Gledhill-Brook Time Recorders, Ltd. (123,602).—This company was registered on August 3rd, with a capital of £10,000 in £1 shares, to take over the business of manufacturers of time-recording machines of all kinds, and the patent rights formerly belonging to the Stockall Brook Time Recorders, Ltd., of Huddersfield, and to adopt an agreement with G. H. Gledhill & Sons, Ltd. The subscribers (with one share each) are:—G. H. Gledhill, Dessingham, Skircoat, Halifax, cash register manufacturer; A. H. Gledhill, 22, Ventnor Terrace, Saville Park, Halifax, cash register manufacturer. Private company. The number of directors is not to less than two or more than seven; the first are G. H. Gledhill (chairman, subject to holding 1,000 shares); A. H. Gledhill (managing director, subject to holding 1,000 shares); G. Gledhill (secretary, subject to holding 250 shares); and E. Hollingworth and F. Brook; qualification, £250; solicitor, E. Booth, 7, Harrison Road, Halifax. Registered office, 43, Market Street, Huddersfield.

CITY NOTES.

Victoria Falls and Transvaal Power Co., Ltd.

THE Marquess of Winchester (chairman) presided on Thursday, August 8th, at Salisbury House, E.C., over the annual general meeting of the above company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 187), said he might fairly claim that it rendered a good account, not only of the past year's operations, but gave every indication of a continuation of the steady progress which had been the feature of the company's business since its inception. The share capital had now all been issued and stood at £3,000,000. The first mortgage debenture capital also had all been issued and stood at £3,000,000, so that the total share and debenture capital issued at the date of the accounts figured at £6,000,000. During the current year the creation of £2,000,000 second mortgage debentures had been authorised and £1,000,000 issued. The creditors amounted to £210,562, and included debenture interest for the half-year to December 31st, 1911, contractors' accounts London and South Africa £42,539, income-tax due in respect of previous year's profits and the balance represented accounts open at the end of the year. The next item, the contractors' retention account of £86,198, also appeared on the other side of the balance-sheet and represented on the one side the money due to the contractors on the completion of their work, and on the other side the amount at the bank kept in reserve against this liability. On the other side of the balance-sheet the leases and concessions and purchase of original undertaking were brought into the accounts at £1,629,006, which was £14,763 less than last year, the difference being accounted for by sales of some of the unused plant, transfer of amounts from this account to the expenditure on new stations, and by £10,785 which had been written off as depreciation. Expenditure on and in connection with new stations stood in the present balance-sheet at £1,398,789, and it was clearly shown in the balance-sheet how the amount was made up as compared with the figure at which this account stood at December 31st, 1910. Since the accounts for the year 1910 were before them they had paid up all the capital they held in the Rand Mines Power Supply Co., Ltd., and the 500,000 shares in that company now stood in the balance-sheet at £500,000. They had also purchased on account of, and handed over to, the Rand Mines Power Supply Co., Ltd., plant amounting to £1,840,228, under their agreement with that company which was secured as to £1,500,000 by a mortgage bond, and by an undertaking to execute a further bond for the balance, which bond would be executed this month. Of the expenditure on plant and machinery there was an item of £64,630 which had not been allocated. This represented the plant and machinery required in the carrying on of the business, but up to the time of the closing

of the accounts the costs of this plant and machinery had not been finally allocated to the different stations; therefore, it appeared in the balance-sheet under a separate heading. The machinery consisted for the most part of standard apparatus for the sub stations, and of spares purchased in connection with the plant already in operation, and would be charged in due course to the station or sub-stations in which it was ultimately employed. The debtors amounted to £92,427, and ample provision had been made for any doubtful debts. The cash amounted to £788,683. The various other items in the balance-sheet, such as stores, furniture and equipment, livestock, vehicles, and harness, preliminary expenses, had been brought into the balance-sheet after liberal depreciation had been written off. Turning to the profit and loss account, the year's work recorded the very satisfactory profit of £323,094, to which had to be added the balance of £37,850 remaining from last year's profit and loss account after payment of the dividend declared at the last annual meeting. This profit had been dealt with as follows:—The interest on debentures and income-tax thereon for the year 1911 absorbed £124,736, and they had written off depreciation amounting to £61,264, and the balance of £137,093 had been carried to the balance-sheet and added to the amount brought forward from the year 1910, thus increasing the balance to the credit of profit and loss account to the sum of £174,943. Out of the balance they paid on June 14th last a dividend on the preference shares issued up to December 31st, 1910, which payment absorbed £129,199, leaving £45,744 to be carried forward to the current year. The dividend declared covered a period of 14½ months at the rate of 6 per cent. per annum, which made the dividend on the preference shares paid up in full to the end of 1910. He had in previous years dealt with the nature and scope of the business, so that there was no need to dwell at any great length on the obligations which they had undertaken for the supply of electricity to the Victoria Falls and Transvaal Power Co.'s consumers, and electricity and compressed air to the consumers of the Rand Mines Power Supply Co., Ltd. The demands which have been made by consumers of both companies for the supply of power to which they were respectively entitled, necessitated that additional capital should be raised in order to supply the demands notified. After much careful consideration they came to the conclusion that the most advantageous way was to raise this further capital by the issue of second mortgage debentures. On April 22nd last the shareholders sanctioned the proposal to create 2,000,000 5½ per cent. second mortgage debentures, of which the issue of 1,000,000 had already been made. The progress of the business had been of such a character that even were they not under the obligation to provide further plant to meet the increasing demands on the capacity of their stations, they would be thoroughly justified in doing so by the return which had been made on the capital represented by plant already brought into commission, and in this respect in referring them to the sum of £323,093—the profit for the year—he would like to emphasise the fact that this profit had been earned although plant representing an expenditure of considerably over £1,000,000 had not been brought into commission at the time to which the accounts referred. During the past year the immense power station at Rosherville was brought into full operation, both for the supply of electricity and compressed air, and the sale of power by the two undertakings on the Rand was now one of the largest in the world, being exceeded as far as he was aware by few other enterprises. The new station at Vereeniging was already being doubled, and there were now four sets each of 15,000 H.P. being installed there. The first two sets and accompanying boilers should be ready to supply power during next month and the two extension sets which were already on the site, would be available early next year. Excepting that again as in the past they had been hampered in their work by unlooked for delays during the past year, due to the stoppage of manufacturing during the recent coal strike, and delays in shipping due to dock strikes, he was pleased to be able to report that the erection of this large station had otherwise been most rapidly carried out. The progress of the construction of the transmission line had been very seriously delayed by the causes he had mentioned owing to their being unable to obtain the necessary insulators. During his recent visit he had the opportunity of thoroughly inspecting the plant in successful operation. When they first started up the earlier plants at Brakpan and Simmer Pan for the company, they met with certain difficulties due to lightning and other causes, but during his visit he saw these two stations running continuously without interruption regulated and controlled. At Rosherville, the biggest by far of the stations which had been erected for the Rand Mines Power Supply Co., and which only came partly into commercial use at the beginning of last year, they experienced similar troubles during the lightning season, whereas the stations at Brakpan and Simmer Pan continued without fault or interruption. In an undertaking where the use of machinery whose output far exceeded the normal standards of manufacturers, however much ingenuity and thought was expended in the construction of the plant, nothing could ensure them, when first putting stations into commercial service, against temporary interruptions of supply, and reliability could only be ensured through experience gained in actual operation. The Rosherville plant of the Rand Mines Power Supply Co., Ltd., station proved no exception. On his arrival in Johannesburg last November on the business of the company and of the Rand Mines Power Supply Co., he was faced with claims for a considerable amount on the latter company under the penalty clauses of its contract with the Rand Mines, Ltd. In the course of negotiations for this settlement, it became evident that the result of experience showed, that however carefully the original contract had been drafted, there were certain alterations which would prove of mutual benefit to the consumers and suppliers, and he was glad to be able to inform them that he found that the representatives of the Rand Mines, Ltd., were quite prepared to recognise the difficulties which had been met, and that they appreciated the manner in which the responsibilities of the undertaking had been carried out. He would like to testify to the manner in which the representatives of the Rand Mines, Ltd., met him in the somewhat difficult negotiations which resulted in the drawing up of a new contract, which, while preserving all the rights which had been obtained under the old contract, would not only largely increase the margin of security of supply to the industry, but would simplify the conditions of many of the clauses and give greater security to the consumers. This new contract had not yet finally been agreed, but the points requiring adjustment were receiving immediate attention, and he hoped before long that the only questions still open would be satisfactorily arranged. The results obtained from the sales of energy in the form of compressed air on a system such as they had installed, and which had not, so far as he knew, been previously adopted, had come up to their estimate, but there was this drawback that the capital expenditure for the installation of the machinery necessary to generate a unit of air involved a higher ratio of capital expenditure than that for the machinery necessary to generate a unit of electricity. The results of this method of distribution of energy had met with the approval of the consumers of the Rand Mines Power Supply Co., and demands for energy in this form had largely increased since the original contract was obtained. The past year had been a most strenuous one for the management in South Africa and the engineering staff, and he could not conclude without acknowledging the great assistance which they accorded him when in South Africa in carrying through the negotiations for the new Rand Mines, Ltd., contract, and for the zeal and energy which they had always displayed in the company's interests.

MR. A. BRAKHAN seconded the motion, and pointed out that as good results had been obtained with only a part of their plant in operation, it must be evident that when the full plant now in course of construction, or being arranged for, was installed, it would ensure a satisfactory and profitable future for the company.

MR. ELLISON said he understood that the power from the Victoria Falls had not yet been touched, but that all the electricity was being generated from coal. When was it propose to tap that source of income, or were they under penalty if they did not utilise that concession? The amount of depreciation included the buildings, plant, &c., and seemed to be very small, considering the value of the plant. He suggested that in future there should be a separation of the items. He thought he was right in estimating a probable profit of £420,000 to £430,000 in the current year, so that the preference shareholders would get their dividend, and he would like to know what hope there was for the long-suffering ordinary shareholders. If they went on as they were going, it seemed to him the ordinary shareholders might hope to get a dividend in 1914.

The CHAIRMAN said they incurred no liability for not making use of the Victoria Falls concession. Obviously to harness such an undertaking as the Zambesi River would not be a remunerative investment unless they had a large sale for power, and they were awaiting developments in the country before attempting to do so. The board would consider the suggestion as to the depreciation account but he was quite satisfied that the shareholders' interests were being most carefully safeguarded in that direction. They maintained the plant at the highest state of efficiency, and made liberal provision for depreciation. If he was asked about the dividend in 1914, he hoped to be able to give further information on the subject; but at the moment he had no wish to prejudice the position of the board by making any statement that day.

The report was then adopted, and the retiring members of the board and the auditors re-elected.

Stock Exchange Notices. — Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Empire District Electric Co.—Fully-paid scrip for 1,500,000 dols. first mortgage 5 per cent. sinking fund gold bonds.

Hadfield's Steel Foundry Co., Ltd.—Further issue of 100,000 ordinary shares of £1 each, fully paid.

And to allow the following securities to be quoted in the Official List:—

American Telephone and Telegraph Co.—25,000,000 dols. additional collateral trust 4 per cent. bonds of 1,000 dols. each (Nos. 28,000 to 53,000).

Toronto Power Co.—Further issue of £800,000 4½ per cent. consolidated guaranteed debenture stock.

The Committee has ordered the undermentioned to be quoted in the Official List:—

Georgia Light, Power and Railways.—2,230,000 dols. first lien 5 per cent. 30-year gold bonds of 1,000 dols. each, Nos. 1 to 2,230; and 62,648 common shares of 100 dols. each, fully paid.

Companies Struck Off the Register.—The following companies have been struck off the Register, and are accordingly dissolved:—

Birmingham Electrical Case Co., Ltd.
British-Bitumen, Ltd.
Cyclops Asbestos Co. (Liverpool), Ltd.
General Power Development Co., Ltd.
Hooghly River Electric Power Co., Ltd.
London Electric Hot Air Baths (Greville's System), Ltd.
North-Eastern Electrical Stores, Ltd.
North Lancashire Electrical Treatment Co., Ltd.
Pyrenees Electrical Society, Ltd.
Railway and Tramway Development Co., Ltd.
Universal Electrical Supply, Ltd.
Variable Electric Lamp Syndicate, Ltd.
Werner-Stuart Steam Generator Syndicate, Ltd.
Wireless Telephony (Entertainments) Co., Ltd.

La Plata Electric Tramways Co., Ltd.

The directors in their report for 1911, say that owing to the discovery that the company's accountant in La Plata had made false entries in the books and had defrauded the company, the directors requested Messrs. Nordaby, Brewster & Co., who are now acting as the company's auditors in La Plata, to make an exhaustive examination of the books for the past two years. They report that they found numerous omissions and false entries, and that as on December 31st last the total defalcations amounted to £7,787. They also report that further defalcations, applicable to the year 1912, amounting to £2,081, have been discovered. The frauds occur on both sides of the accounts. Miscellaneous receipts have been kept back, and fictitious invoices presented for payment. The directors are at a loss to understand how these frauds, continued over so many months, can have been overlooked by the manager and the company's late auditors in La Plata who have countersigned the monthly and annual accounts sent to London. The directors are much concerned at these discoveries, and are using all possible means to ascertain the facts. Mr. Hamilton, the chairman of the company, is on his way to La Plata, holding full powers to act. The accounts presented are based on the accounts as corrected after the examination, and represent the state of affairs as at December 31st, 1911. The traffic receipts, £48,948, have been up to the original estimate. The working expenses are 68 per cent., and have been affected by two causes, viz., disturbance of traffic owing to paving operations, and the partial use of horse traction. The electric working expenses are 63 per cent. The horse traction section is conducted at a loss. The balance of profit for the year is £14,673, less £7,787 loss by defalcations; interest aborbs £1,500; £5,352 has been distributed in interim dividend on preference shares, and £23 remains. The defalcations since December 31st, 1911, will have to be dealt with in the next account. The following is a comparison of the traffics for the two years ending December 31st, 1910, and December 31st, 1911 :—

	Passengers carried.	Receipts.
1910	3,564,576	£34,483
1911	5,228,355	£48,948

The route to Ensenada is practically complete, except at the crossing of the railway. These crossings are being constructed by the railway company at this (the tramway) company's cost.

Mr. W. W. Western presided on August 8th at River Plate House, E.C., over the third annual general meeting of the above company, and in moving the adoption of the above report, he said he would divide his remarks into two portions—first, as regarded the accounts of the year, and secondly, regarding the circumstances under which the company had sustained heavy losses. Traffic receipts amounted to £48,900, and miscellaneous receipts to £700. The traffic receipts were already in excess of the original estimates, and the comparison was all the more satisfactory because the original estimate was for the completed line, whilst, as a matter of fact, they were still working with one section not electrified. The uncompleted section was that connecting the town with the port of Ensenada. The old horse line followed the bank of the harbour canal and commanded hardly any intermediate traffic. The substituted line ran along a paved road, along which buildings were being erected which would give a substantial intermediate traffic in addition to the normal traffic between the town and the docks. The necessity for obtaining an Act of Congress, and difficulties with regard to the crossing of the railways, had delayed proceedings, but according to the latest advices, the line was practically finished saving the railway crossings. So far as they understood, it would take about a month to complete the crossings. Extensive paving operations carried out by the municipal authorities had interfered with the traffic and also affected their expenses ratio. Their original estimate of expenses was 65 per cent., but the actual rate was 68 per cent. An analysis of the account, however, showed the rate for the electric tramway to be 63 per cent. As the work was still uncompleted, they had not dealt with depreciation, but they recognised that as a charge which could not be neglected. The traffic receipts for the current year were somewhat in excess of the corresponding period, but he was disappointed that they did not show a substantial increase. Their local director attributed it to the effect of the electrification of the municipal horse line, and possibly he was correct, but in view of the rapid growth of the town coupled with their possession of the best routes, he (the chairman) did not fear for the future. It was a matter of very great concern to the directors that so large a proportion of the profits had been swept away by the fraud of an employé, and it was a matter of still greater concern to them to find the frauds continued over a considerable length of time without discovery. Proceeding to explain the company's system of control at La Plata, the chairman said they had M. Boutell as local director, who acted as intermediary between the company and the authorities, and advised the board on questions of policy, but who did not interfere with details of working. The manager, Mr. Dore, was the manager of the old horse tramways, and he did the routine work, and referred to the local director in cases of difficulty. Two years ago, their accountant resigned his position, and the local director found a man on the spot, Mr. Allan, whose credentials were satisfactory, and he was appointed. Outside there was what was locally called the station-master. The tramway conductors got out way bills showing the tickets issued, &c., and each day paid their takings to the station-master, whose duty it was to pay them into the bank. It was the manager's duty to see that the amount paid into the bank tallied with the way bills. The company's payments were made from another bank and cheques were signed by the manager or director and countersigned by the accountant, and before the cheque was signed the accountant had to produce the corresponding merchant's invoice or other document to be marked by the manager. There were local auditors, whose duty it was to examine the cash accounts, and monthly accounts were sent to the London office, from which the company's books were made up. Up to 1911, Messrs. Fowler and Co. audited for the company locally, but from that date Messrs. Nordaby, Brewster & Co., who were in close touch with the company's London auditors, had done the work. The board were on the point of sending out the balance-sheet when they received a telegram, stating that frauds had been discovered. They at once instructed Messrs. Nordaby, Brewster & Co. to make a strict examination of the accounts for the past two years, and it came as a terrible blow to the board to learn that frauds amounting to nearly £10,000 had been going on over a period of nearly two years. The accountant had obtained money from the stationmaster and had manipulated his books, and had also retained money due to suppliers and produced duplicate invoices and got cheques. It was incomprehensible to the board how the frauds escaped the notice of the manager, and how he and the auditor signed monthly sheets without discovering the discrepancies between them and the actual balance in the bank. Mr. Woodrow, the secretary, was now in La Plata, and Mr. Hamilton, the chairman, was on the high seas, with full power to act, and would remain in La Plata to make arrangements for protecting the company's interests. Referring next to a note in the auditors' certificate regarding the value of stores, the chairman said that that had relation to a quantity of old material valued at £1,200 or £1,300, and he could not say what the true value of it was. As regarded the procedure that day, he suggested that they might either formally adopt the report and call another meeting when Mr. Hamilton came back, or else adjourn the present sitting.

Mr. Harmood Banner, M.P., seconded the motion, and also expressed regret at the frauds which had occurred.

Replying to a question, the Chairman said that an application was at once made for a warrant for the arrest of the accountant, but apparently they did things in a different manner in that country, and the Judge was holding an inquiry not only into the actual losses of the company, but with regard to who was responsible for allowing them to be robbed, but he had not communicated anything to them.

A long discussion took place, principally with regard to the advisability of getting auditors for the company who were actually represented by a branch in Buenos Ayres, and eventually the meeting was adjourned till a date to be fixed after the return of Mr. Hamilton.

Perth Electric Tramways, Ltd. (W.A.).

The directors' report shows that, for the year ended December, 1911, there was a profit of £37,893, which is an appreciable increase over any former year and compares favourably with the year 1910, which was adversely affected by the strike of conductors and motormen. The directors have already distributed an interim dividend of 2½ per cent. on the ordinary shares, and now recommend the payment of a further 2½ per cent., making 5 per cent. for the year. After making this payment and distributing the dividend on the preference shares, and interest and sinking fund on the first and second debentures, there remains a balance of £9,742. The directors recommend that £9,000 of such amount should be placed to cash reserve fund, bringing such fund up to £19,741, leaving £742 to be carried forward. As stated in the circular issued in June, the directors have signed a provisional contract for the sale of the undertaking to the Government of the State of Western Australia for £475,000, which agreement is conditional (amongst other things) on the Government obtaining certain consents from the various municipal authorities from whom the company's concessions are held. As the Perth City Council refused to give its consent, the Government took the necessary steps to bring in an Act of Parliament enabling them to purchase the tramways without the consent of the Perth City Council, and the Bill is now before Parliament. There seems to be no doubt that the Bill will, in due course, become law, and after an intimation has been received that the Bill has been passed by the Western Australian Parliament, the necessary meetings of shareholders will be called, and the agreement submitted for confirmation. The latest information received is that the Bill has passed the second reading and is now in the Committee stage. The amount of the first debenture stock redeemed in respect of the year under review is £5,050 at a cost of £5,207. The directors record their appreciation of the services of Mr. Somerset and his staff during the year.

Mr. H. J. Somerset, the manager and engineer, in his report, says that during the year 1911 no new construction work was carried out. The trams travelled 1,230,910 miles, as against 1,011,510 miles in 1910. The total receipts were £86,528, as against £68,455 in 1910, an increase of £18,073. The total Perth expenses in 1911 were £45,441, as against £38,479 in 1910, an increase of £6,962. The excess of receipts over expenditure was therefore £11,111 greater than in 1910. The earnings per car-mile were 16·87d. in 1911, as against 16·24d. in 1910; while the expenses were 8·85d., as against 9·13d. in 1910. The expenses per cent. of earnings in 1911 were 52·47 per cent., as against 56·21 per cent. in 1910. The mileage constructed is 30 miles 11 chains.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer book and register will be closed from August 19th to 31st inclusive, for the preparation of warrants for dividends payable on 31st inst.

Manaos Tramways and Light Co., Ltd.

The directors in their third annual report for the year ended April 30th, 1912, state that during the year both the tramway and lighting sections of the business improved. The tramway receipts amounted to £109,718 and the lighting to £35,603, against £105,867 and £33,595 respectively for the previous year. The number of passengers carried has increased by 234,000, and four large cars are being put into service to cope with the increased business. The public lighting has been increased by the addition of the 23 arc lamps, the company now supplying electricity for 345 arc lamps, and with every likelihood of a further increase being necessary in the near future. In the private lighting section 584 new customers have been secured, increasing the number of 16-c.p. lamps by 4,969, and making the total number of lamps now connected 15,065. The property has been maintained in first-class condition and is well equipped, every care having been taken to place the company in a position to meet the demands of the public. Up to the present time the company has confined its operations to electric traction and lighting, but it is now actively engaged negotiating for the sale of power to the various works in Manaos. The result of the company's operation for the year is a profit of £34,828, which compares with £30,431 for the previous year. After providing for London expenses, &c., and debenture interest amounting to £18,510, there remains a balance of £16,319, plus £3,509 brought forward, making £19,828, which the directors recommend should be dealt with in the following manner:—To contingencies reserve, making a total to the credit of this account of £10,000, £2,500; to renewals reserve, making a total to the credit of this account of £15,000, £5,000; dividend on £300,000 ordinary shares at rate of £3 per cent. per annum, £9,000; to be carried forward £3,328. The meeting is to be held in London on August 20th.

Underground Electric Railways Co. of London, Ltd.

The directors in their report for the June half-year, state that the net revenue from investments and properties (including general interest), after deducting general expenses, amounted to £208,666, plus amount receivable under guarantee on Metropolitan District Railway assented first preference stock £2,687, making £211,352, less interest charges on £1,730,000 4½ per cent. bonds of 1933 remaining outstanding, and expenses of redemption of £1,088,700, redeemed January 15th, 1912, which absorbed £43,447, leaving a surplus of £167,906. This amount will be applied as follows:—In payment, on September 2nd, 1912, of interest at the rate of 6 per cent. per annum on £1,181,981 6 per cent. first cumulative income debenture stock for the June six months, £35,459; interest at the rate of 4 per cent. per annum plus income-tax on £6,110,031 6 per cent. income bonds of 1948 for the June six months, £129,771; balance carried forward, £2,676. The income from investments for the half-year shows an increase of £101,877 over that for the corresponding half-year of 1911. Included in this amount is the income from the company's holdings in the London General Omnibus Co., Ltd., which appears for the first time in the revenue account, and, therefore, prevents a true comparison. By reason of the sale of the power house undertaking to the Metropolitan District and London Electric Railways Joint Committee, as of January 1st, 1912, the income from the operation of that undertaking disappears from the revenue account, as does the charge for interest on the securities redeemed with the proceeds of such sale.

The traffic and working expenses of the railway companies and of the London United Tramways, Ltd., have been adversely affected by the general labour unrest during the half-year. The Metropolitan District Railway Co. has paid in respect of the half-year a dividend at the rate of 2 per cent. per annum on its 5 per cent. second preference stock, on which no payment was made for the corresponding period last year. The London Electric Railway Co. has paid dividends at the same rates in respect of this half-year as in the corresponding half-year. The construction of the Paddington and Charing Cross extensions is proceeding satisfactorily. The Bills promoted by the Metropolitan District Railway Co., the London Electric Railway Co., the Edgware and Hampstead Railway Co., and the London United Tramways, Ltd., the main provisions of which were explained at the last meeting, received Royal Assent on August 7th.

The directors proceed to give particulars of the scheme for the fusion of the interests of the company and the London General Omnibus Co., Ltd., and the progress that has been made with it.

The item stocks, shares and other property stands in the books at £13,518,642, and consists of stocks and shares in associated companies, as well as of lands and buildings. The increase of £2,529,956 in the figure shown in the balance-sheet, as compared with the corresponding figure (£10,988,686) at December 31st, 1911, results mainly from the acquisition of the ordinary stock of the London General Omnibus Co., Ltd., acquired under the scheme, and from expenditures in connection with the Edgware and Hampstead Railway. The new capital items appearing in the balance-sheet are the first cumulative income debenture stock the "A" ordinary shares, and an addition to the 6 per cent. income bonds of 1948, which securities were issued in exchange for the ordinary stock of the old London General Omnibus Co., Ltd., under the terms of the scheme. The item of calls unpaid (in course of collection) has been reduced during the half-year from £111,477 to £7,477. As a result of the sale of the power house undertaking, material improvement in the position of the company is shown in the balance-sheet. The 4 per cent. first power house debentures, amounting to £1,000,000, have been paid off, and the 4½ per cent. bonds of 1933 have been reduced by the redemption of £1,088,700 (leaving the amount now outstanding £1,730,000), and, in addition, certain suspense items have been either reduced or entirely written off.

Paisley District Tramways Co.

The result of the half-year's working to June 30th, 1912, is as follows: Revenue £28,697, expenses £18,046, leaving £10,651, less extra cost electrical energy due to coal strike £316, general interest £274, interest on debentures £1,600, and debenture sinking fund £750, leaving £7,711 plus £2,559 brought forward. The balance is £10,271, which is to be disposed of thus: £1,500 to general reserve account; £3,750 to dividend on £150,000 cumulative 5 per cent. preference shares for the half-year; £1,000 to preference share sinking fund; £2,025 to dividend at the rate of 2½ per cent. per annum on the ordinary shares for the half-year; carrying forward £1,996. The traffic receipts show an increase of £2,359, compared with the receipts for the corresponding half-year of 1911. Owing to the increasing traffic four additional cars have been ordered and will be put into service shortly. The expenses were £3,363 in excess of the expenses for the first half of 1911. This increase is to a considerable extent in connection with the maintenance of the permanent way, necessitated largely by the increasing heavy commercial motor traffic. The dividends will be paid on 23rd inst.

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
Dec., 1910 ..	14·69	5,756,773	£24,773	1·03d.	511,731	50
June, 1911 ..	17·98	6,009,072	£26,121	1·04d.	559,021	56
Dec., 1911 ..	17·98	6,487,033	£28,736	1·06d.	608,502	56
June, 1912 ..	17·98	6,597,579	£28,480	1·04d.	619,850	56

The American General Electric.—The New York correspondent of the *Times*, writing on July 26th on the subject of "Business in the United States," states that General Electric stock advanced vigorously, the reason being an announcement that stockholders would be given a 30 per cent. stock dividend. The dividend, he goes on to state, was not wholly unexpected, but it is "one of the largest 'melons' received by stockholders of any Corporation for a long time . . . . The company's stockholders will meet on August 29th to vote upon the proposed increase in the capital stock from $80,000,000 to $105,000,000. After such increase there will be paid to stockholders of record December 31st, 1912, out of the surplus earnings of the company, a dividend of $30 per share, payable in stock of the company at par. Such dividend is to recoup stockholders in part for dividends passed or reduced in the years after 1893. For the future financial needs of the company it is proposed to issue debentures from time to time, and for this purpose the directors have authorised an issue of debentures limited to $60,000,000 bearing 5 per cent. interest or less."

Falkirk Electric Construction Syndicate, Ltd.—An extraordinary general meeting has been held to consider a resolution that the capital be increased for the purpose of carrying out the scheme for the extension of the Falkirk tramways to Grangemouth. The resolution was moved by Mr. G. M. Brown, chairman of the board of directors, who presided. A direct negative was moved and seconded by Mr. A. W. Tait and Mr. George Balfour respectively, and after a vote this became the finding of the meeting. The effect of the decision is that the extension of the tramways to Grangemouth will be delayed.

Paignton Electric Light Co., Ltd.—The annual meeting was held on Wednesday last week. During the year £6,967 was expended on capital account, chiefly on new mains, cables and machinery. The trading showed a profit of £847, less £306 for depreciation, leaving a gross profit of £541. The sale of electricity increased during the year from £822 to £1,667. The destructor showed a profit of £142, and the tarring department of £239. Since December 31st new condensing plant has been installed, at a cost of £1,200.

Continental.—France.—The balance-sheet of the Compagnie Continentale Edison, of Paris, for the last financial year shows a profit of £154,420, as compared with only £134,708 in the preceding 12 months.

Switzerland.—The report of Messrs. Brown, Boveri & Co., of Baden, for the last financial year shows a net profit of £97,772, as compared with only £92,001 in the preceding 12 months. The dividend is being maintained at 7 per cent.

Waste Heat and Gas Electrical Generating Stations, Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum for the half-year ended July 31st, payable less income-tax on August 31st.

Claud Hamilton, Ltd.—The directors' report for the year ended April 30th a net profit, including £2,060 brought forward, of £6,964. After writing down property account by £500, a dividend of 10 per cent. is declared, carrying forward £2,698.

Electric Supply Co. of Victoria, Ltd.—The directors have declared a dividend of 6 per cent. on the preference shares on account of arrears.

Para Electric Railways and Lighting Co., Ltd.—The directors announce an interim dividend at the rate of 10 per cent. per annum on the ordinary shares for the half-year.

Liverpool District Lighting Co., Ltd.—The directors have declared an interim dividend of 2 per cent.

Tyneside Electrical Development Co., Ltd.—The directors have declared an interim dividend of 5 per cent.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, August 14th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2⅝d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16 10	..
a Copper Sulphate	„	£24 15	..
a Lead, Nitrate	„	£26 10	..
a „ White Sugar	„	£25 10	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5 5	..
a Soda, Caustic (white 70/72 %)	„	£10 5	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£80	..
b „ Wire, in ton lots	„	£102	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	9⅛d.	⅛d. inc.
c „ Tube (brazed)	„	11⅜d.	⅛d. inc.
c „ „ (solid drawn)	„	10d.	⅛d. inc.
c „ Wire, basis	„	9⅛d.	⅛d. inc.
c Copper Tubes (brazed)	„	1/0⅝d.	⅛d. inc.
c „ „ (solid drawn)	„	11⅜d.	⅛d. inc.
g „ Bars (best selected)	per ton	£95	..
g „ Sheet	„	£95	..
g „ Rod	„	£95	..
d „ (Electrolytic) Bars	„	£82	10s. inc.
d „ „ Sheets	„	£100	10s. inc.
d „ „ Rods	„	£88 10s.	10s. inc.
d „ „ H.C. Wire	per lb.	10⅜d.	⅛d. dec.
f Ebonite Rod	„	5/8	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/7	..
h Gutta-percha, fine	„	6/6 to 8/6	..
h India-rubber, Para fine	„	5/-	1d. inc.
i Iron Pig (Cleveland warrants)	per ton	61/-	2/4 inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£19 15 to £20	inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 5	5s. dec.
e Mica (in original cases) small	per lb.	6d. to 3s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large	„	7/6 to 11/-	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/0½	..
p „ „ rolled strip & sheet	„	1/1	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£210 to £211	£2 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/5	..
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£29 15	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd
p
r W. F. Dennis & Co.

Calgary Power Co.—The directors report that a commencement was made with the delivery of power on May 1st, 1911, but only on a very limited scale. Subsequently, however, a full service was undertaken, and the accounts now presented show a total of $81,318 in respect of gross earnings for the eight months from May 1st to December 31st, 1911, including dividend on investment. The net earnings totalled $61,600, and, after deducting interest charges, amounting to $47,600, there remains a surplus of $14,000 to be carried forward. Construction work is now being rapidly completed, with the exception of the storage reservoir and second transmission line, but the latter will probably be finished before the coming winter season, while the reservoir dam has already been handed over by the contractors, and the directors confidently expect that a sufficient quantity of water will be stored for use during the low stage of the river this year, thereby materially increasing the capacity of the plant and ensuring a more reliable service.

STOCKS AND SHARES.

Tuesday Evening.

Although the Stock Exchange usually expects to drag through the holiday season with little to disturb the tenor of its dulness, the present month has proved an exception to general custom, and quite a distinct revival of speculative interest has been witnessed in many departments. This is chiefly to be accounted for by the extremely low levels to which the majority of stocks had fallen, owing to the over-speculation in the earlier part of the year, and the consequent ease with which they rose when the re-investment of the half-yearly dividends began to take place.

As our lists of last week very clearly proved, most of the concerns connected with the electrical industry did not share in this depreciation, but are, on the contrary, considerably better since the beginning of the year. Therefore, it is only natural to find that the stocks and shares which we quote, do not supply any very decided tendency except in the case of those in the Home Railway market, where prices have been subjected to the influences referred to in the previous paragraph.

Undoubtedly the railway stocks have been the most interesting, and some really good advances have been scored. After creeping up steadily throughout last week, prices became almost buoyant on Monday. Large lines of stocks were bought which, it was said in the Stock Exchange, were on behalf of the syndicates who forced prices up in the spring. Chief attention, as usual among electrical railways, was paid to Metropolitans and Districts, which, after their continued dulness, had come back to a level giving ample margin for recovery. The former jumped 3¾ to 57, and Districts, with a three points rise, managed to climb over 40 again. Opinion is divided as to the staying power of these stocks, the sharpness of the appreciation leading to the fear that an equally quick reaction may follow. City and South London, though by no means a bad market, did little more than recover the point they lost last week. Profit-taking after the rise which followed the opening of the extension to Liverpool Street led to a fall of a point, to 76, in Central London Ordinary. There is still some fear expressed that the extra passengers carried will not justify the expenditure, as it is thought that the end of the journey for the majority will still be the Bank Station.

Though Underground Electric Railway 6 per cent. Income bonds have shared in the general improvement, with a rise of three points to 91, they were not directly influenced by the report, issued on Monday evening, which was very much according to market expectations. Any true comparison with the results of last year is impossible owing to the inclusion of the income derived from holdings in the London General Omnibus Company, but the payment of a dividend of 4 per cent. on the 6 per cent. Income bonds (compared with 1½ per cent. a year ago) and a carry forward of £2,700 shows that satisfactory progress has been made. The chief cause of the increased revenue is, of course, due to the acquisition of the omnibus stock, but it is interesting to note that the payment of 2 per cent. on District Railway second Preference, as against nothing, meant £13,800 extra for the Underground Company.

English electricity supply shares have not displayed any great activity of late, though what movements there have been are generally in an upward direction. On top of their recent rise, County of London Preference have put on another ⅛ to 12⅛, while Brompton and Kensington Ordinary and Westminster Ordinary have gained equal amounts to 8⅞ and 8⅝ respectively. Amongst English tramways, the only movement that calls for special mention is a drop of ⅛ in London United Tramways Preference to 5⅛, and except for recoveries in India-Rubber and Gutta-Percha, Babcock and Wilcox and Edison & Swan "A" shares, there is nothing of particular interest in the manufacturing division.

The Latin-Canadian group has shown some disposition towards recovery after the falls which naturally followed the large advances. Mexico Tramways have been very active, dropping back at one time, but at the lower level support was forthcoming with a result that a further rise of two points to 128½ was scored by the Common and half that amount by the 5 per cent. bonds. Rio de Janeiro Tramways improved at one time, but the rise was not maintained. Monterey Light and Power Debenture have been in some request, and Canadian General Electric Common have also advanced. Sao Paulo First Debenture declined a point to 106.

The issues of the British Columbia Electric Railway have been bought fairly extensively, and the Deferred, Preferred and 5 per cent. Preference have each gained a point, but Anglo-Argentine Tramways First Preference fell back $\frac{1}{16}$ to 5¼.

Chief interest in the Telegraph market has been centred upon Marconi shares, which have slumped rather severely. It was, of course, according to Stock Exchange custom to put down the price when the details of the deal with the Government were made public, on the idea that there was "nothing more to go for"; but the decline has been aided by some uneasiness caused by the postponement of the House of Commons' debate on the subject, and also by vague talk of improved patents which would have a serious effect on the prospects of the company. The Ordinary were at one time down to 4¼, and Americans and Canadians have also been flat. Speculation in National Telephone Deferred is not on such a large scale as hitherto, the disposition being to await the resumption of the arbitration proceedings in the autumn. The price has improved, however, to 144. Reuter's have been very dull, falling 15s. to 10½, on sales by holders wishing to exchange into the new shares. Any further drop on this account is not to be expected, as, allowing for dividend, the values at present prices now approximate. Among other changes in this department may be noted small rises in Eastern Telegraph and Eastern Extension.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Aug. 13th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	*					
Do. 4½ % Pref.	10	5½	5½	9¾ — 10¾	..	5 2 4
Do. Second 6 % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. 4½ % Deb. Stock	10	6	6	10¾ — 11	..	4 10 0
Brompton & Kensington, Ord.	Stock	4½	4½	98 —100	..	4 10 0
Do. 7 % Cum. Pref.	5	10	10†	8⅜ — 9⅛	+ ⅛	5 9 7
Central Electric Supply, 4 % Guar. Deb.	5	7	7	7½ — 8¼	..	4 4 10
Charing Cross, West End & City	100	4	4	97 —100	..	4 0 0
Do. 4½ % Cum. Pref.	5	5	5	4⅛ — 5	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4¾	..	4 14 9
Do. Do. 4 % Deb.	5	4½	4½	8¾ — 4¾	..	5 6 0
Chelsea, Ord.	100	4	4	94 — 96	..	4 3 4
Do. 4½ % Deb.	5	5	5	4⅜ — 4⅝	..	5 2 7
City of London, Ord.	Stock	4½	4½	97 —100	..	4 10 0
Do. 6 % Cum. Pref.	10	7	8	17½ — 19½	..	4 2 1
Do. 5 % Deb.	10	6	6	13½ — 15½	..	3 17 5
Do. 4½ % Second Deb.	Stock	5	5	118 —122	..	4 2 0
County of London, Ord.	100	4½	4½	99 —102	..	4 8 3
Do. 6 % Pref.	10	5	6	11½ — 11⅞	..	5 2 2
Do. 4½ % Deb.	10	6	6	11⅝ — 12⅜	+ ⅛	4 17 0
Do. 4½ % Second Deb.	Stock	4½	4½	106 —108	..	4 3 4
Edmundson's, Ord.	Stock	4½	4½	100 —103	..	4 8 3
Do. 6 % Cum. Pref.	5	Nil	Nil	1/16 — 1/16	..	Nil
Do. 4½ % First Mort. Deb.	5	Nil	Nil	3— 3½	..	Nil
Folkestone	100	4½	4½	84 — 87	..	5 3 6
Do. 5 % Cum. Pref.	5	6	6	4⅝ — 5⅛	..	5 14 3
Do. 4½ % First Deb.	5	5	5	4⅝ — 5⅛	..	4 15 3
Hove	100	4½	4½	92 — 95 xd	..	4 14 9
	5	9	9	7½ — 8	..	5 12 6

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Aug. 13th.	Rise + or Fall —	Presen Yield p.c. £ s. d.
Kensington & Knightsbridge, Ord	*					
Do. 4 % Deb.	5	9	9	7⅞ — 7⅞	..	5 16 2
Kent Elec. Power, 4½ % Deb.	Stock	4	4	90 — 93 xd	..	4 6 0
London Electric, Ord.	Stock	4½	4½	78 — 82	..	5 9 9
Do. 6 % Pref.	3	2	2½	1⅜ — 1⅝	..	4 0 8
Do. 4 % First Mort. Deb.	5	6	6	5 — 5½	..	5 9 1
Metropolitan	Stock	4	4	90 — 93	..	4 6 0
Do. 4½ % Cum. Pref.	5	5	4	3⅞ — 4	..	6 1 3
Do. 4½ % First Mort. Deb.	5	4½	4½	4¼ — 4⅜	..	4 17 4
Do. 3½ % Mort. Deb.	Stock	4½	4½	99 —102	..	4 8 3
Midland Electric Corporation 4½ % First Mort. Deb.	Stock	3½	3½	86 — 88	+ ½	3 19 7
Newcastle-on-Tyne 5 % Pref., Non-Cum.	100	4½	4½	97½ — 99½	..	4 10 6
North Metropolitan Power Supply, 5 % Mortgages (Red.)	5	5	5	4⅜ — 4⅞ xd	..	5 2 7
Notting Hill, 6 % Non-Cum. Pref.	100	5	5	100 —103	..	4 17 1
Oxford	10	..	6	10 — 11	..	5 9 1
St. James' and Pall Mall, Ord.	5	7½	7½	5⅞ — 6⅜	..	5 13 9
Do. 7 % Pref.	5	10	10	8 — 8⅜ xd	..	5 14 3
Do. 3½ % Deb.	5	7	7	6⅜ — 7¼ xd	..	4 16 7
Smithfield Markets, Ord.	100	3½	3½	83 — 86	..	4 1 5
South London, Ord.	5	Nil	2	1⅜ — 1⅝	..	..
Do. 5 % First Mort. Deb.	4	5	5	3 — 3½	..	5 14 3
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1/16 — 1/16	..	5 17 8
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	5	..	¼ — ¾	..	..
Do. 5 % Cum. Pref.	5	5	2	2⅜ — 3	..	3 6 8
Do. 4½ % First Mort. Deb.	100	4½	4½	80½ — 88½	..	5 1 8
Westminster, Ord.	5	10	10	8⅜ — 8⅞	+ ⅛	5 12 8
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅜	..	4 3 0

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅜ — 5⅝	..	5 2 2
Calcutta, Ord.	5	8½	8½	7⅞ — 8	..	5 6 3
Do. 5 % Pref.	5	5	5	5/16 — 5/16	—1/16	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	96— 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7†	114 —119	+1	5 17 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	3	3†	1⅜ — 1⅝	..	3 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	..	6 9 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	99 —101	..	4 19 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 1/16	..	Nil
Do. 6 % Pref.	1	6	6	1⅝ — 2⅛	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	..	..	1⅞ — 2⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89 — 91	..	5 10 0
Mexican Lt. & Power, Common	$100	4	4	93 — 96	..	4 3 4
Do. 7 % Cum. Pref.	$100	7	7	109 —112	+1	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96⅛ — 98⅛ xd	— ⅛	5 1 6
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88½ — 90½	+ ½	5 10 6
Montreal, Lt., H. and Power	$100	7	8	233 —243 xd	..	3 5 9
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 42	..	11 18 2
River Plate, Ord.	Stock	10	10	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	109 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 1
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	152 —157	+1	3 3 8
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 —110	..	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 5 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½ —101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref.	1	Nil	11¼d.	5/32 — 1⅜	+ 3/32	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105½ — 107½	..	5 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7⅛ — 7⅞	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	96⅛ — 98⅛	..	5 1 6
American Telep. & Teleg., Cap.	$100	8	8†	149 —151	..	5 6 0
Do. Collat. Trust	$1000	4	4	93⅛ — 95⅛	..	4 3 9
Anglo-American Telegraph	Stock	8½	8	67⅛ — 69⅛ xd	..	5 7 11
Do. 6 % Pref.	Do.	6	6	113 —114 xd	+ ⅜	5 5 3
Do. Def.	Do.	80/-	80/-	26⅛ — 26⅝	— ¼	5 13 2
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102½ —104½	..	4 16 2
Chili Telephone	5	7	..	7⅛ — 7⅞	..	4 10 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82⅛ — 84⅛	+ ½	4 14 8
Cuba Telegraph	10	6	6†	9⅛ — 10⅛	..	5 14 3
Do. 10 % Pref.	10	10	10	16⅛ — 17⅛	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	8¼ — 8⅝	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	7 — 7⅛	..	6 9 0
Direct United States Cable	10	4½	5	7⅜ — 7⅝ xd	..	6 7 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	5†	128½ —131½	+ ½	5 6 5
Do. 8½ % Pref. Stock	Do.	8½	8½	77⅛ — 79½	+ ½	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	98½ —100½	..	3 19 7
Eastern Extension	10	7	5†	18 — 13⅜	+ ⅛	5 3 8
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97 —100	..	4 0 0
Globe Telegraph and Trust	10	5⅞	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12½ — 13	..	4 12 4
Great Northern Telegraph	10	18	18	28½ — 29½	..	6 3 1
Indo-European Telegraph	25	13	5†	56 — 58	..	5 3 5
Mackay Companies Common	$100	5	5	90 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	20	4⅛ — 4⅜	—1/16	4 6 7
Do. 7 % Cum. Partic. Pref.	1	16	17	3⅛ — 3⅜	—1/16	4 11 2
Monte Video Telephone, Ord.	1	6	6	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	1/16 — 1/16	..	5 6 8
National Telephone Def.	Stock	6	6	143 —145	+1	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100—101	+ ⅛	4 9 1
Oriental Telep. and Elec.	1	8	8	1 3/32 — 1 7/32	+ 1/16	4 6 9
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1⅜	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	8 18 5
Reuter's	8	5	5†	10½ — 10⅞	— ⅜	3 14 5
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7⅜ — 7 7/16 xd	..	5 7 7
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 11 0
West Coast of America	2½	2½	2½	1⅛ — 1⅜	..	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	½	2⅜ — 2⅝	..	1 16 4
Do. 6 % Cum. 1st Pref.	10	6	6	10½ — 10⅝	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅝ — 10⅛	..	5 17 1
Do. 5 % Debs.	100	5	5	100½ —102½	..	4 17 .
Western Telegraph, Ltd.	10	7	6†	12⅝ — 13⅜	..	5 4 .
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Aug. 13th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	Nil	—	+ 1/32	Nil
Do. 5 % Pref.	1	5	5	13/16 — 15/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref.	100	..	..	11 — 13	..	..
Do. Do. Deferred	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	90 — 93	..	6 9 0
Do. 7 % Non-Cum. Pr'f.	100	..	..	89 — 92	−1	..
Do. 5 % Perp. Deb.	100	5	5	97 —100	..	5 0 0
Do. 4½ % 2nd Deb.	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	3	3	75 — 77	−1	3 17 11
Do. Pref.	100	4	4	81 — 83	..	4 16 5
Do. Def.	100	2	2	73 — 75	..	2 13 4
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
City & South London, Ord.	100	1½	1½	34 — 35 xd	+ 1½	4 12 10
Do. 5 % Pref., 1891	100	5	5	106 —108 xd	..	4 12 7
Do. Do. 1896	100	5	5	102 —104 xd	..	4 16 2
Do. Do. 1901	100	5	5	102 —104 xd	..	4 16 2
Do. Do. 1903	100	5	5	101 —103 xd	..	4 17 1
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10½ — 11½ xd	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅛ — 2⅛	..	Nil
Hastings Trams, 6 % Pref.	1	Nil	6	—	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼ — 2⅜	..	4 11 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	..	4 3 4
London United Trams, 5 % Pref.	10	Nil	..	4⅞ — 5⅛	— ⅛	..
Do. 4 % Deb.	100	4	4	73 — 77	..	5 4 0
Metropolitan Railway Consol.	100	1⅜	1⅞	56½ — 57½	+3½	3 5 6
Do. Surplus Lands	100	2⅜	2⅜	66 — 68	−1	4 3 4
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	85 — 87	..	4 0 6
Metropolitan District Ord.	100	Nil	Nil	40½ — 41	+3	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	3½	4½	91 — 93	+1	4 17 10
Do. 3½ % Gtd.	100	3½	3½	74 — 76 xd	..	4 12 1
Metropolitan Elec. Trams, Ord.	1	5½	6	1 — 1⅛	..	5 6 8
Do. Def.	1	Nil	..	—	..	Nil
Do. 5 % Pref.	1	5	5	—	..	5 4 2
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	99 —102	+1	4 19 0
Potteries, Ord.	1	2	..	—	..	..
Do. 5 % Pref.	1	5	5	—	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	—	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4 — 4⅛	..	Nil
Do. "A"	1/-	..	..	—	..	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	90 — 92	+3	..
Yorkshire (West Riding), Ord.	5	Nil	..	—	..	Nil
Do. 6 % Pref.	5	Nil	3	2½ — 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5⅛	5⅛ — 5⅜	−1/16	5 2 4
Do. 2nd Pref.	5	5	5⅛	4⅛ — 5	..	5 6 0
Do. 4 % Deb.	100	4	4	93½ — 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	99½ —101½	..	4 8 8
Do. 5 % Deb.	100	5	5	101 —103	..	4 16 2
Auckland Trams, 5 % Deb.	100	5	5	102 —104	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	11¼ — 12 xd	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	97 — 99	+ 1	4 10 11
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord.	5	8	8	7 — 7⅛	..	5 6 8
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100⅜ —103¾	+ 1	4 7 0
B. Columbia Elec. Rly., Def.	100	8	8½	136 —141	+ 1	5 13 6
Do. Pref. Ord.	100	6	6	116 —121 xd	+ 1	4 19 2
Do. 5 % Pref.	100	5	5	107½ —110½	+ 1	4 10 6
Do. 4½ % 1st Mort. Deb.	40	4½	4½	99½ —102½	..	4 7 10
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	102 —104	..	4 6 7
Calcutta Trams, Ord.	5	6	7	6⅜ — 6⅝	..	5 5 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 1/16	+ 1/16	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	Nil	2½†	—	..	..
City Buenos Aires Trams (1904)	5	5	5	5 5/16 — 5 7/16	..	4 10 6
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	—	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	5	3	35½ — 43½	..	6 18 0
La Plata Elec. Trms, Ord.	1	..	..	—	..	..
Do. Pref.	1	6	6	8⅜ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6	1 — 1½	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb.	100	5	5	89 — 92	..	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	103 —105	..	4 15 2
Mexico Trams Com.	$100	7	7	127 —130	+2	5 7 8
Do. Gen. Con. 5 % Bonds	..	5	5	101 —103	+1	4 17 1
Do. 6 % Bonds	100	6	6	102½ —104½	..	5 14 10
Para Elec. Rlys. & Lt., Ord.	5	10	10	7⅜ — 7⅝	..	6 11 2
Do. 6 % Pref.	5	6	6	5 — 5⅛	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	100 —102	..	4 18 0
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1 1/16 — 1 1/8	..	1 18 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 5⅝	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	4½	5†	150 —153	..	3 5 4
Do. 1st Mort. 5 % Bonds	..	5	5	102⅜ —103⅜	..	4 16 5
Do. 5 % Mort. Bonds	100	5	5	99½ —100½	..	4 19 8
Sao Paulo Tram, Lt. and P.	$100	10	10†	260 —265	..	3 15 6
Do. 5 % 1st Deb.	$500	5	5	105 —107	−1	4 13 6
Singapore Trams, 5 % Deb.	100	5	5	82½ — 85½	..	5 17 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98 xd	..	5 2 0
Un. Elec. Trams Monte Video	5	6	7	5½ — 6	..	5 16 8
Do. 6 % Pref.	5	6	6	4½ — 5⅝	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	100 —103	..	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	—	..	8 0 0
Do. 6 % Pref.	1	9	6	1 1/16 — 1 1/8	..	7 7 8
Babcock & Wilcox	1	26	28	3 1/16 — 3 5/64	+1/16	8 3 0
Do. Pref.	1	6	6	1⅜ — 1½	..	4 0 0
British Aluminium, Ord.	1	..	..	1 3/16 — 1 7/32	..	..
Do. 6 % Cum. Pref.	1	..	..	—	..	..
Do. 5 % Prior Lien Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	84 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	10	7¾ — 8¼	..	6 1 3
Do. Pref.	5	6	6	6⅝ — 6¾ xd	..	4 14 1
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10
British Westinghouse, Pref.	3	Nil	..	7/16 — 1/2	..	Nil
Do. Deb.	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	2/- —3/-	..	Nil
Do. Pref.	1	Nil	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb.	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	10†	10¾ — 11	..	6 16 4
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 14 1
Do. Deb.	100	4½	4½	99 —101	+ ½	4 9 1
Castner-Kellner	1	17½	20	8⅜ — 8¾	..	5 6 8
Do. Deb.	100	4½	4½	102 —105 xd	..	4 5 9
Crompton & Co.	3	Nil	Nil	—	..	Nil
Do. Deb.	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	5	—	..	5 14 3
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb.	100	4½	4½	95 — 98	..	4 10 10
Edison & Swan, A, £3 paid	5	Nil	..	—	+ ⅛	Nil
Do. fully paid	5	Nil	..	1 1/16 — 2 1/8	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb.	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	2½	3⅜	— 1 xd	..	7 10 0
Do. Pref.	2	7	7	1⅝ — 2 xd	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	4 10 1
Do. Deb.	100	4	4	92 — 97	..	4 2 6
Henley's, Ord.	5	15	10†	12 — 12⅜	..	5 16 8
Do. Pref.	5	4½	4½	4⅝ — 5⅛	..	4 7 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	10	..	9 — 10	+ ¾	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	20	10†	32½ — 34½	..	6 16 6
Do. Deb.	100	4	4	97 — 99	− 1	4 0 10
Willans & Robinson	1	Nil	..	—	..	Nil
Do. Pref.	5	Nil	..	—	..	Nil
Do. Deb.	100	4	4	58 — 60	..	6 13 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., May 9th, 1912.

ELECTRICAL APPLICATIONS OF REINFORCED CONCRETE.

The following article (abstracted from one by P. Lecler in *L'Ind. Electrique*), is solely concerned with the following applications of reinforced concrete work in the electrical field: (1) Partitions and partition work for switchboards; (2) conduits, boxes and tanks; (3) reinforcement of wooden poles *in situ*, without disturbing the lines carried by the poles.

Partitions and Cellular Work for Switchboards.—High-tension switchboards are almost exclusively built on the cellular principle, and reinforced concrete has become a most popular material for

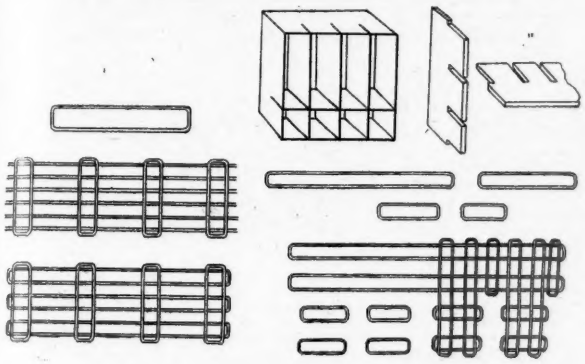


Fig. 1.

Fig. 2.

their construction. The available space is often very restricted so that it becomes important to make the walls of the cells as thin as possible while still completely covering the reinforcement with concrete.

The reinforcing members may be composed of small iron sections, cut up and built together as required, or of expanded metal lattice cut to form panels of the same size as the cell walls. In either case, skilled labour is required, and it is a difficult matter to obtain thin and quite flat panels in which the structural steel is conveniently placed, particularly if the panels are of large size. In the case of switchboards having several tiers of superposed compartments, it is difficult and almost impossible to make the panels in advance. The skeleton must first be erected and then covered with cement—a costly and difficult operation, which may be considerably simplified by using rectangular frameworks, such as are shown in fig. 1. These frames are machine made, of standard dimensions, and are delivered at the works ready for use. Sets of the frames may be used in conjunction with straight bars, or with other frames of various sizes, as indicated in the upper and lower parts of fig. 1. The latter construction is obviously the more rigid, and is less liable to deformation during erection.

The use of these frameworks is specially advantageous in the construction of such a board as that illustrated in fig. 2. The various panels fit into each other in a manner exactly similar to that employed by carpenters, and the most complex boards can be built up from panels completed in advance.

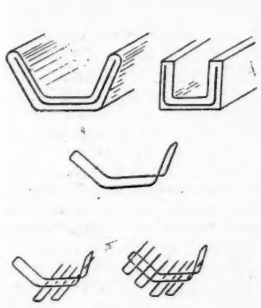


Fig. 3.

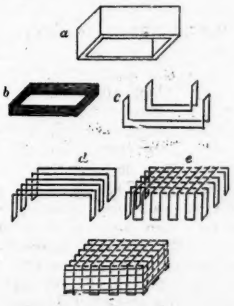


Fig. 4.

Conduits, Boxes, Tanks, &c.—The frames which compose the reinforcement of the above structures may be applied to almost any other case. For instance, the skeletons of ducts may be formed by longitudinal bottom, and side frames carried by similar, but shorter, frames, twice bent at 90° or a larger angle. The successive stages in the erection are shown in fig. 3, and it is hardly necessary to point out that the ends of the longitudinal frames must be staggered to secure uniform shear strength throughout.

By combining two sets of frames bent twice at right angles and tying the whole by means of a square or rectangular spiral (see fig. 4), the skeleton of a box or tank may be formed by the successive stages shown.

So far, no mention has been made of the means by which the component frames are tied together. Ordinary annealed iron wire may be used for this purpose, but this process, which has hitherto been exclusively employed, requires—despite its primitiveness—considerable skill in application, if good results are to be secured. It was quite a reasonable method when skilled workers had, in any case, to be employed for the fitting and erection of the skeletons, but when ready-made frames, requiring a minimum of skill in erection are employed, it is necessary to evolve a form of ligature which shall be as easily applied.

The "Centrator" clips shown in fig. 5 are formed from steel wire and are almost instantaneously attached by the stages shown in

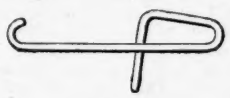


Fig. 5.

fig. 6. The clip is placed round one rod N at D and the limb D B, which spans the second rod M, is bent down so that the hook B engages under N after which, the joint is completed and tightened by bending down and straining the end F.

Reinforcement of Poles.—It is well known that a large percentage of pole replacements are undertaken solely on account of serious rotting at the ground level, the remainder of the pole being quite fit for years' more service. Such replacements are specially objectionable by the interruption of service they involve, and, during recent years, numerous successful means have been devised for strengthening the damaged sections of poles by reinforced concrete. The method employing spiked stirrup-irons spanning the site of the rotted wood (the latter being chopped or scraped

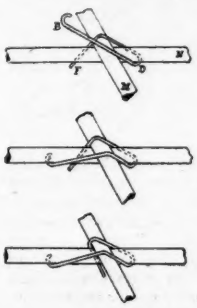


Fig. 6.

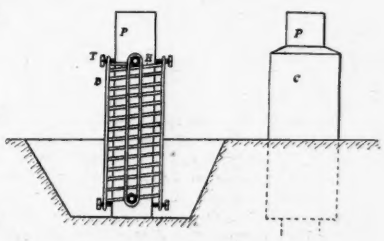


Fig. 7.

away), and filled round with cement, has already been described in these columns. Another method—rather more elaborate, and designed to be applied as a preventative of ground rotting—is shown in fig. 7; the left-hand view shows the skeleton ready for cementing, and the right-hand view shows the completed job. The reinforcing member, which can be fitted without any disarrangement of lines carried by the pole, comprises a helix H, and bars or rectangular frames B—in number and size sufficient to resist the bending moment to which the pole is subject. The helix is of springy steel wire, wound to a diameter slightly greater than that of the pole; to place it on the pole, it is held in a horizontal position near the latter (see fig. 8), and the end A is sprung on to

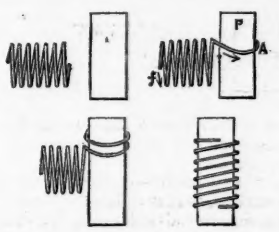


Fig. 8.

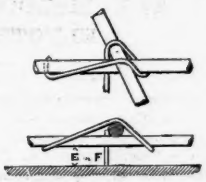


Fig. 9.

the pole as shown. By turning A round the pole in the sense shown by the arrow on P, meanwhile turning the disengaged portion of the helix in the sense shown by the arrow *f*, the whole of the coil can be rapidly worked on to the pole. The longitudinal members should preferably be rectangular frames, as shown at fig. 7, B, in which case the ends are screwed to the post as indicated. To complete the whole operation, a two-part mould is placed round the skeleton and a quick-setting cement is run in.

There are two difficulties to contend with in the above process. On the one hand, it is difficult to ensure, even with the co-operation of a good workman, that the mould is placed concentrically with the post and remains so during the pouring and setting; while, on the other hand, there is a great tendency for the coils of the spiral to sag, leaving much too wide a pitch between the upper turns. When using ordinary iron binding wire for the joints between helix and vertical bars or frames, these difficulties are quite serious, but by using special clips, such as shown in fig. 9, and leaving the tail F projecting, a minimum thickness of cement equal to the length E is automatically ensured. Again, by using stiff waved-wire for spacing purposes (see fig. 10), holding it in place by the same clips as are used for connecting the main members of the reinforcement, uniform pitch is ensured between turns of the

helix. Under the most unfavourable conditions possible, the ends of one or more sets of wires F will lie flush with the surface of the concrete when set, and, even if the latter is not painted or coated, the worst that can happen is the appearance of a small patch of rust round the projecting metal.

As shown by fig. 7, the use of rectangular frames, instead of straight bars, provides an easy means of attaching the reinforcement to the pole. Further, the frames stiffen the helix and reduce the risk of their deformation during erection; this advantage is specially important in the case of large helices, such as are used for pipes, well rings, and so on. Fig. 11 shows a skeleton built up from a circular helix, and also one using a rectangular helix; vertical stiffening frames and spacing wires are used, and the whole is bound together with clips similar to those shown in figs. 5 and 9.

Conclusions.—The special object of the above methods of construction is to reduce to a minimum the difficulties of fitting and erecting reinforced concrete work—particularly of those classes most used in electrical applications.

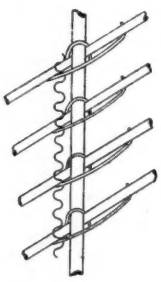


Fig. 10.

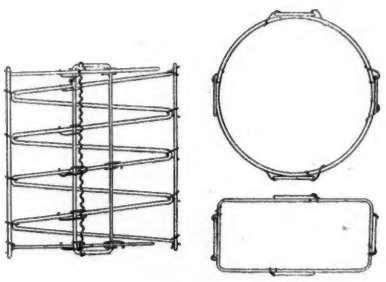


Fig. 11.

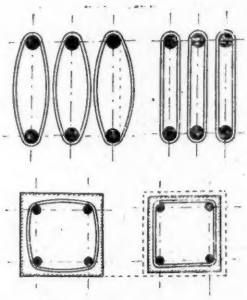


Fig. 12.

The reinforcing members may be broadly divided into two categories—first, the principal bars, forming the greater part of the weight of the whole and requiring little or no manipulation after leaving the manufacturer's works; and secondly, relatively light pieces, such as stirrup irons, helices, and so on. The latter need skilled labour in their manufacture and should preferably be made to standard gauge, and delivered ready for immediate use. The cost of carriage on such ready-made goods is more than compensated by the lower cost and greater accuracy of their manufacture by firms specialising in their production. The accuracy of form of machine-made members enables smaller and lighter designs, with the same spacing of the main bars and an equal thickness of cement over the outer metal; this point is well illustrated by fig. 12.

Finally, the regularity of the skeleton enables great accuracy in the dimensions of the completed partition, box or other part, and entirely avoids the necessity for surface layers of cement which, owing to their coefficient of contraction being greater than that of reinforced concrete, are either broken themselves (during setting), or seriously injure the enclosed structure. (M. Maynard, at the Copenhagen Congress in 1910, stated that this effect had often been observed in connection with beams and similar structures.)

THE MELBOURNE RAILWAY ELECTRIFICATION.

The Melbourne correspondent of the *Railway Gazette* recently discussed the specifications—published in the local papers—for the proposed suburban electrification scheme.

Some extracts from his letter are published below:—It was arranged that tenders should be invited, so that reliable information might be available to enable the relative advantages of the direct-current and single-phase alternating-current systems of electric traction to be definitely appraised. The comparison of the two systems will be facilitated, too, by the fact that tenderers are being invited to quote for the maintenance of the train equipments, which constitutes an important factor in the variation in the operating costs between the direct and alternating-current systems.

The specification for the power station buildings, boiler-house equipment and plant, sets out as general conditions that the normal steam consumption of each generating set may be taken as 240,000 lb. of steam per hour; the plant is to be designed for a normal continuous output of 720,000 lb. per hour; the boiler house equipment shall generate and supply steam at 210 lb. pressure per square inch above the atmosphere, and at a normal temperature of 600° F., to the turbines and auxiliary plant at the power station and extensions.

The power station is proposed to be located on Crown land at Yarraville, and connected by rail with the Williamstown line, and also provided with facilities for obtaining coal by water, thus affording alternative means of obtaining fuel supplies. The water for the condensing plant is to be obtained from the river.

For the purposes of the calculations, it is assumed that the whole of the power required for railway purposes will be generated at the Yarraville power house, and tenderers are invited to quote for the supply of four generating sets of 20,000-kw. each, or alternatively six sets of 10,000-kw. each, with the necessary accessories and boiler and condensing plant to suit. This plant is common to both systems of traction, as it is proposed that in either case three-phase current be produced and transmitted to the distributing points at a voltage of 20,000. The equipment thus provided differs from that recommended by Mr. Merz in his report of 1908 in that the latter provided for eight generating sets of 3,750 kw. each, or a total of 30,000 kw., from which power was to be transmitted at a voltage of 12,000. It is proposed in the case of the single-phase system that the power be conducted to the trains by overhead conductors operating at from 10,000 to 11,000 volts, and that under the direct-current system the power be also conveyed to the trains by an overhead conductor operating at from 1,300 to 1,550 volts, with an average of 1,450 volts. The original recommendation of Mr. Merz provided for a direct-current system, with a third, or conductor, rail operating at 800 volts, and the change to an overhead conductor with the higher average voltage of 1,450, indicates the advance which has taken place in the development of the direct-current system since that time.

The trains are still proposed to be worked on the multiple-unit system, and the specifications provide that the equipment must admit of 10 cars—five motor-cars and five trailers—being attached together if circumstances render it necessary to so increase the size of the trains. The number of cars provided for in Mr. Merz's previous report was 496, and tenders are now invited for the equipments for 950 cars.

The average speed, including stoppages, of the trains under electric traction was previously fixed by Mr. Merz at 20 miles per hour, but it is now proposed that an increase be made to the average rate of about 21 miles per hour, and an illustration of the increase in speed which is proposed, as compared with steam, may be obtained from the particulars given to tenderers by Mr. Merz in respect of the times of stopping trains on the lines from Flinders Street to Sandringham, and Flinders Street to Essendon. Thus:—

	Electric traction. Former.	Present.	Steam traction.
Flinders Street to Sandringham ...	31 min.	30 min.	40 min.
Flinders Street to Essendon ...	18½ „	17½ „	23 „

The lighting of the cars will be by electricity, and electric power will also be used to operate the Westinghouse air brake.

Tilmanstone Colliery.—At the meeting of the Snowdown Colliery, Ltd., held at Dover, on Friday, 2nd inst., the chairman, Mr. Arthur Barr, said, according to the report in the *Financial Times*:—"Perhaps you would like to know the latest from Tilmanstone. . . . . The principal thing we have been waiting for has been the switchboard, an immense machine which weighs a good many tons, I am told, although I have never seen it myself. It takes six months to make one. It arrived from Berlin on Saturday and is down No. 3 shaft at the present moment, and Mr. Metzger told me that in 10 days' time it would be all wired up and ready for work. The three new horizontal permanent pumps are also down the pit and are being fitted. That is a very short job. The rising mains to take the water are now actually fitted in the shaft and in duplicate. Mr. Wroe tells me that he will be pumping by the end of this month of August."

Accident.—A correspondent writes:—"A remarkable escape from death from electrical shock is reported from Birmingham, where Albert Davis, a boy 11 years of age, came in contact with a cable carrying current at 6,000 volts, and was not killed. Davis had been playing with another boy at a spot between Salford Bridge and the storm water pumping station. Here the wires conveying current to the works are carried under the River Tame, and come into the open at a terminal pole which is surrounded by a brick wall 6 or 7 ft. high, and coped with broken glass laid in cement. Thus closed in, the cables are on the Drainage Board's private property. The boys scaled this wall, and obtained access to a ladder some 30 ft. high. They then got into a cage where the terminal wires are protected. Davis caught hold of one and received a terrible shock, which knocked him backwards. Sparks flew in all directions from his body, he was burned about the arms, hands and neck, while his body generally was much discoloured. He was removed to the local hospital, where he soon showed signs of recovery."

ITALIAN EXPORTS OF ELECTRICAL GOODS.

The following statement shows the exports of electrical and similar goods from Italy during the year 1910 as compared with 1909, and should be of interest in view of the expansion of the Italian electrical and engineering industry. Notes of increases or decreases as compared with the previous year are given, and it will be noted that although the trade is comparatively small, the increases proportionately are large:—

	1909. Lire.	1910. Lire.	Increase or decrease. Lire.
Boilers.—			
To Portugal	—	44,000	+ 44,000
„ Egypt	71,000	103,000	+ 32,000
„ Argentina	70,000	179,000	+ 109,000
„ Brazil	6,000	15,000	+ 9,000
„ Uruguay	62,000	90,000	+ 28,000
„ Other countries ...	119,000	70,000	— 49,000
Total ...	328,000	501,000	+ 173,000
Steam engines, semi-fixed (with boilers attached), hot air, compressed air, gas, petrol, &c., motors.—			
To Portugal	22,000	136,000	+ 114,000
„ Roumania	—	122,000	+ 122,000
„ Egypt	48,000	214,000	+ 166,000
„ Argentina	237,000	593,000	+ 356,000
„ Turkey	8,000	155,000	+ 147,000
„ Other countries ...	126,000	360,000	+ 234,000
Total ...	441,000	1,580,000	+1,139,000
Dynamo-electric machines weighing more than 1,000 kg.—			
To France	28,000	26,000	— 2,000
„ China	8,000	21,000	+ 13,000
„ India and Straits Settlements	23,000	49,000	+ 26,000
„ Argentina	94,000	305,000	+ 211,000
„ Other countries ...	126,000	56,000	— 70,000
Total ...	279,000	457,000	+ 178,000
Ditto, less than 1,000 kg.—			
To Austria	18,000	20,000	+ 2,000
„ France	19,000	23,000	+ 4,000
„ Germany	12,000	21,000	+ 9,000
„ Switzerland	10,000	14,000	+ 4,000
„ Other countries ...	57,000	61,000	+ 4,000
Total ...	116,000	139,000	+ 23,000
Machinery not specified in the statistics (excludes agricultural, textile, printing, &c.).—			
To Austria	141,000	179,000	+ 38,000
„ France	272,000	257,000	— 15,000
„ Russia	56,000	195,000	+ 139,000
„ Switzerland	166,000	217,000	+ 51,000
„ Germany	349,000	687,000	+ 338,000
„ Algeria	33,000	111,000	+ 78,000
„ Argentina	235,000	370,000	+ 135,000
„ Brazil	81,000	147,000	+ 66,000
„ Other countries ...	587,000	613,000	+ 26,000
Total ...	1,920,000	2,776,000	+ 856,000
Electric accumulators, and parts thereof.—			
To Austria	—	40,000	+ 40,000
„ Argentina	—	19,000	+ 19,000
„ Other countries ...	13,000	12,000	— 1,000
Total ...	13,000	71,000	+ 58,000
Parts of dynamo-electric machines and transformers.—			
To Germany	24,000	14,000	— 10,000
„ Spain	5,000	11,000	+ 6,000
„ Switzerland	31,000	6,000	— 25,000
„ Argentina	1,000	14,000	+ 13,000
„ Brazil	1,000	16,000	+ 15,000
„ Other countries ...	39,000	36,000	— 3,000
Total ...	101,000	97,000	— 4,000
Electrical apparatus.—			
To Austria	3,000	15,000	+ 12,000
„ Germany	12,000	24,000	+ 12,000
„ Argentina	2,000	13,000	+ 11,000
„ Switzerland	7,000	3,000	— 4,000
„ Other countries ...	9,000	17,000	+ 8,000
Total ...	33,000	72,000	+ 39,000

	1909-10. Lire.	1910-11. Lire.	Increase or decrease. Lire.
Incandescent electric lamps.—			
To Austria	28,000	10,000	— 18,000
„ Germany	36,000	39,000	+ 3,000
„ Other countries ...	17,000	30,000	+ 13,000
Total ...	81,000	79,000	— 2,000

25 lire = £1.

MECHANICAL TROUBLES WITH TRAMCAR BRAKE GEARS.

It may be said without fear of contradiction that the brake equipment of a tramcar is one of the most important parts of the mechanism, inasmuch as should there be any failure to operate in emergency, the consequences in damage to life and property might be enormous. Hence it is an important part of the duties of the maintenance staff of a tramway authority to keep the brake gears in good working condition.

The principal causes of failure in connection with such gears are dirt and wear. The component parts are very largely exposed to the action of dust, water, and in some cases oil, so that there is every chance for the formation of a heavy sticky coating of extraneous dust and dirt, having the tendency to clog the parts, and also in the case of gritty dust to cause undue wear. Hence actual cleaning, as opposed to the theoretical kind of thing which the ordinary cleaner puts into the work, if not closely watched, is absolutely necessary, and it is also essential that very frequently the component parts should be examined in detail to see whether wear is so far advanced that renewal or repair is necessary.

Quite a typical case can be observed occasionally in connection with the brake handles when these are fitted with a ratchet and spring. The action of the spring is, of course, to hold the top half of the ratchet into the bottom half, while, at the same time, giving the necessary release. If, however, care is not taken periodically to clean out the recess at the top of the brake staff, dirt will find its way into it and clog it up, stopping the action of the spring. The result of this is that the handle can be moved in either direction without turning the brake staff, and should this occur while the car is on an incline the danger will be at once obvious.

The effect of wear is most easily seen in connection with the ratchet and dog which are used for the control of the brake staff, by means of the driver's foot, inasmuch as this is placed in a position where it is bound to be covered with any grit which happens to get on to the footboard, and hence there is, owing to the constant rubbing action, great wear on the dog and on the ratchet wheel. A case occurred on one tramcar in which the dog itself got so worn that it did not hold into the ratchet when the driver's foot was applied, with the result that for a moment there was quite an exciting time until the alternative brakes could be got into action. After this it became a point of rule to see that the dogs were removed as soon as they showed any undue signs of wear, and to see that the ratchet wheels themselves were kept up to a state of proper efficiency.

Another instance of wear occurred on a tramcar equipment which shows the necessity for careful examination at the depôt before the car goes out on the road, inasmuch as in this case the defect could not very easily be observed by the driver. Owing to the fact that the pin on the floating lever of the brake had become somewhat worn, and also as under the continued vibrations of the car this pin came out of the floating lever while the car was on one of its journeys, the lever dropped, throwing the hand brake entirely out of gear. Reliance had, therefore, to be placed on the alternative brakes, until the car could be run over a pit at the depôt, and the lever fixed again. Part of the car overhaul should consist of the careful examination of all pins and fastenings to see that undue wear has not taken place, and to see that the safety devices such as split pins, &c., are not missing.

On one occasion a car had to be pulled up suddenly on an emergency, and the driver, who was equipped with more muscle than judgment, managed to apply his hand brake with such vigour that the pull rod was actually pulled over the staff at the rear end, the chain hanging loose. The result of this was that the pull rod had to be sawn in two in order to let off the brake again, and the only satisfaction which the driver got out of the incident was that he had demonstrated his muscular strength. The incident, however, shows the inadvisability of allowing much play on the brake movement, and also that the whole travel of the brake should be taken up by an ample length of chain without the possibility of allowing the rod itself to come into contact with the staff.

These are a few simple points which will probably appeal to those who are interested in maintaining car equipments, and the subject has been limited to parts of the equipment which are very often treated as a matter of course and almost subsidiary portions, inasmuch as the mechanical arrangement of the parts is so absurdly obvious. However, even in the simplest and plainest portion of the car equipment, care and judgment are necessary in the overhaul and maintenance of the parts.

RULES FOR ELECTRIC OPERATING STAFFS.

[COMMUNICATED.]

During the past few years the attention of electricity supply engineers has been directed more to the external, or business-getting, than to the internal organisation, considered from a technical point of view, of the works. This, of course, is only intended to be a general statement, inasmuch as there are, of course, very many instances where engineers have been thoroughly impressed with the importance of maintaining a definite technical organisation, but the position has been rather forced upon the electric industry of going after fresh business, to the partial exclusion of other activities, partly on account of the fact that the metal-filament lamp made it necessary, on its introduction, to bring up the drop in load as quickly as possible, and partly also because there has been a boom in what may be described as commercial methods. At the same time, without at all disparaging this side of the work, it may be necessary now and again to remember the old themes in order to realise that electrical works will not run automatically or at haphazard.

Presumably, the younger generation of electrical engineers are passing through the electricity supply undertaking systems for the purpose of gaining experience, although it must be admitted that many of them are staying there because they cannot get an opening into any other branch. For general all-round responsibility on the part of the junior engineers of the undertaking, there is, perhaps, no finer field of training than the medium-sized generating station and mains system. The large installations, such as supply big cities, specialise the departments to such an extent that all-round experience is practically impossible, while the very small undertakings are, of course, only useful for initial experience. This being the case, it is not surprising that in the medium-sized undertakings there are a large number of keen engineers who are there to gain experience and who possess previous experience and a fair share of common-sense. As this may be taken as the average product of the electrical engineering profession, it is interesting to inquire into the methods of organisation of such plant with respect to the duties of the staff. The medium-sized undertaking occupies a more than usually interesting position in this respect, as, on the one hand, sufficiently precise instructions must be given to avoid overlapping or neglect of duties in the various departments, and on the other, such organisation must not be carried to a point where red-tapism becomes ridiculous.

The rules governing the operation of generating plant and mains in any station are more or less local in character, depending on the plant used and the system adopted, but in general characteristics they are, or should be, of the same tendency. One would, therefore, expect to find in most medium-sized stations sets of rules laid down which would be more or less the counterpart of each other. As a matter of fact, this is not the case.

Inquiry among a considerable number of electrical supply undertakings has revealed the fact that some chief engineers have made no standard rules; others make them, but regard them as private, and it is only a small proportion that have really standardised to such an extent that any comparison could be made, with the object of formulating anything like the standard requirements for the regulating of the operating staffs of such stations.

Dealing first of all with the first class, there is, of course, a good deal to be said in favour of the avoidance of a stringent set of rules. In the medium-sized plant, the engineers employed have, presumably, previous experience, and have ordinary initiative and common-sense. If it were attempted to saddle them with too many rules, two things would happen. First, there would be a tendency to confuse them at a critical time, or to badger them afterwards for non-adherence to rules which, although in themselves excellent, might not have applied to the particular case. The second result would probably be that some engineers would lose self-respect through being bound down too tightly, and would not do their best in an emergency. For these reasons, a good many chief engineers are of the opinion that a good operating engineer in time of emergency must work "off his own bat," and on this account no regulations are laid down. The only thing which can be said against the above position is that there is a distinct difference between routine operation and emergency work, and by a clear understanding of what routine is, and adherence to it, many emergencies could be avoided. Hence, it would seem advisable to have certain standard rules clearly enunciated and presented to the operating engineers.

This brings us to the position of the next class of chief engineers, who formulate rules but regard them as private documents. Obviously, in some instances, this is necessary. It would not do to reveal to all and sundry the eccentricities of behaviour of some of the plant installed in generating stations or on mains, by publishing rules which arise from the necessity of humouring such plant; but apart from this, there does not seem to be any reason why, for the benefit of the whole community and for the avoidance of eccentricity, standard rules should not be laid down and published. We are living to-day in an age of standardisation, and it goes almost without saying that operating costs would be materially reduced if in general terms the engineer from one plant could pick up his duties at another without having to unlearn a good deal of special regulation which he had already acquired. The case is analogous to engineering on board ship. The nearer the plant and regulations governing it conform to standard practice, the quicker the engineer picks up his duties. For this reason it must be fairly stated that the practice which is adopted in some electrical undertakings by the chief of issuing orders on sheets of foolscap, to be placed in an instruction book which has to be read periodically by the engineers in charge and mains engineers in order to refresh their memories, is not a perfect way of doing things. In such collections of orders it will not be improbable that regulations bearing on a certain subject contradict themselves at different dates, thus reducing the whole arrangement to confusion. We are, therefore, again brought to the point that the formulation of a standard set of regulations for operation is necessary.

Bearing in mind, therefore, that while giving ample play to the resource and initiative of the operating engineers, some form of general system of working should be laid down so as to avoid the interference of one department with the operations of another, the question arises as to the points which may best be included in such a scheme of rules. Briefly speaking, they may be summarised under two heads. First, the routine operations, not of an obvious character, which are necessary in order to maintain the plant in an efficient condition. For example, in a wisely-conducted station the plant should be subjected to regular periods of overhaul and inspection, these periods being determined not arbitrarily, but by considerations of the length of running, which, by experience of a particular part of the plant, can be allowed without thorough overhaul. This system is simply following out methods which have been found advisable on railways and other large undertakings involving running plant. The writer believes that similar systems are also being adopted in connection with colliery undertakings possessing mechanical and electrical appliances, which have to be periodically inspected for safety and efficiency. A clear set of rules regarding such matters as, for example, valve drill—that is to say, the opening and closing of valves upon a steam or water system in order to detect any leakages, and to perfect the staff with a view to rapid operation in case of emergency—is a thing which could readily be formulated, and similar matters will suggest themselves to those in charge of electricity supply plants. Such rules are necessary, and need not be made absurd. For example, every shift engineer knows how to parallel one unit with another, or how to keep a check on the cells of a battery, and such matters need not appear in routine regulations. There are, however, many other things which in some stations are not noted at all, and which in others are scribbled down in the form of orders on loose sheets of paper by the chief, which could be carefully tabulated and made into a permanent record.

(*To be concluded.*)

Hadfield's Steel Foundry Co., Ltd.—The directors announce an interim dividend of 1s. per share, free of tax, on the ordinary shares.

NATIONAL INSURANCE ACT, 1911.

Umpire's Decisions under Unemployment Section of Act.

By JOS. J. H. STANSFIELD, F.C.I.S.

Sec. 84 of the National Insurance Act, 1911, states that every workman employed in any of the trades mentioned in the Sixth Schedule to the Act must be insured under the Unemployment Section of the Act.

The Sixth Schedule reads as follows :—List of Insured Trades . . . relating to Unemployment Insurance.

1. Building : that is to say, the construction, alteration, repair, decoration or demolition of buildings, including the manufacture of any fittings of wood of a kind commonly made in builders' workshops or yards.

2. Construction of works : that is to say, the construction, reconstruction or alteration of railroads, docks, harbours, canals, embankments, bridges, piers or other works of construction.

3. Shipbuilding : that is to say, the construction, alteration, repair or decoration of ships, boats or other craft by persons not being usually members of a ship's crew, including the manufacture of any fittings of wood of a kind commonly made in a shipbuilding yard.

4. Mechanical engineering, including the manufacture of ordnance and firearms.

5. Ironfounding, whether included under the foregoing headings or not.

6. Construction of vehicles : that is to say, the construction, repair or decoration of vehicles.

7. Sawmilling (including machine woodwork) carried on in connection with any insured trade, or of a kind commonly so carried on.

It will be noted that neither electrical engineering nor the supply of electricity are included in the schedule, but it must not, therefore, be assumed that the electrical industry is exempt from the provisions of this part of the Act, for it must be borne in mind, in the first place, that under Sec. 107 (2) of the Act, "in determining any question as to whether a workman is, or has been, employed in an insured trade or not, regard shall be had to the nature of the work in which the workman is engaged, rather than to the business of the employer by whom he is employed," and, in the second place, the ramifications of the electrical industry are of such an increasingly extensive character, that the schedule touches both employers and employed more or less in all its sections.

In deciding whether a workman is insured or not many doubtful points arise, and to solve such difficulties an umpire was appointed under the provisions of Sec. 89 of the Act, and up to August 1st last over 700 decisions have been advertised in the *Board of Trade Journal*. An inspection will show that many of these directly or indirectly affect those engaged in the electrical industry.

Only "workmen" are insurable under the unemployment part of the Act, and workman is defined by Sec. 107 (1) to mean "any person of the age of 16 or upwards employed wholly or mainly by way of manual labour," and a decision as to inclusion or exclusion in the first place turns on the words "wholly or mainly by way of manual labour."

Similar words are to be found in the Workmen's Compensation Acts, and there have been many decisions on the matter. A difficulty arises because many persons are employed in employments which involve both manual and other forms of labour. The question is one of fact, the principal rule to determine the matter being to see whether manual labour is the general duty of the employé, or only incidental and subsidiary to other more important mental duties, and the distinction between manual labour and manual work must also not be overlooked.

In deciding the points submitted by the representatives of the many industries, the umpire has endeavoured throughout to avoid inconsistencies, but being bound by the schedule he has in many cases been forced into decisions which lead to inconsistent results.

This is well shown in the decision on the laying and jointing of mains and services, and the erection of overhead lines, such work coming, in the opinion of the umpire, within the meaning of the words "other works of construction" in the second section of the schedule. These are as follows :—Workmen *are* included when jointing new cables, but *not* included when jointing cables for the purposes of repair, or taking branches from mains in consumers' premises ; workmen *are* included who are employed in underground mains, &c., where the cost is chargeable to capital account, whilst workmen are exempt who are repairing such mains, the cost of which is chargeable to revenue account.

In new work or large extensions workmen are usually engaged specially for the work, whilst repair work and services are carried out by the permanent staff, and a dividing line is thus roughly drawn which has not been lost sight of in making decisions ; but this is not an invariable rule, and the average workmen will hardly appreciate why contributions are deducted one week and he is exempt the next, for whilst such distinctions may be well founded in law they seem to be far from common sense.

However this may be, the Act must be obeyed, and it is hoped that the following list of inclusions and exemptions may be of assistance to all concerned ; but before proceeding further it will be well to state that the word "workman" includes both male and female, and the following workmen are excluded in all cases :—(1) Persons under 16 ; (2) indentured apprentices ; and (3) foremen or gangers who are not wholly or mainly employed by way of manual labour.

The list is divided so as to distinguish between (1) mechanical engineering, which is closely allied to electrical manufacturing ; (2) electrical engineering ; (3) manufacture and laying of cables, the erection of overhead lines and street lighting ; (4) generation and supply of electricity ; (5) tramways ; (6) buildings ; and (7) works of construction. The letters and numbers refer to the umpire's decisions.

Mechanical Engineering.—Contributions *are* payable in respect of workmen employed in or as :—

1. Fitters, turners or finishers, erectors, millwrights, planers, borers, slotters, screwers, shapers, iron sawyers, grinders (iron and steel), glazers, millers, polishers, buffers and drillers (machine), machinemen (others than those specified), drillers (hand), smiths, smiths' strikers, toolsmiths and toolmakers (A. 20).

2. Coremakers, casters, moulders, dressers, polishers, finishers and fitters, their helpers and labourers engaged in the manufacture of brass, white metal, gun-metal or other copper alloys (A. 23).

3. Goods hoists attendants (A. 50).

4. Wheelwrights (A. 85).

5. Cranemen (hand or power), enginemen and firemen (stationary engines), and boilermen (A 86).

6. Sheet metal workers ; manufacture of copper fittings and appliances (coppersmiths, &c.) (A. 88).

7. Making boilers for generating steam for power or heating (A. 315).

8. Labourers and general shop labourers (A. 319).

9. Saw hammerers and sharpeners, knife, tool and cutter grinders, gas-fitters, oilers of shafting, lime washers, gas producer men, pump fitters, belt attendants and strap piecers, pattern makers, press tool makers, machinery testers manually employed, and machinery painters (A. 337).

10. Engine testers (bench test prior to erection in chassis) and car testers (after erection) manually employed (A. 341).

11. Manufacture of forgings for mechanical and vehicle building establishments (A. 372).

12. Boiler and steam pipe coverers and applying non-conducting material to steam boilers and pipes (A. 574).

Contributions *are not* payable in respect of the following :—

1. Timekeepers, watchmen, storekeepers, draughtsmen, tracers, gatemen, weighmen, passenger hoist attendants, closet and office attendants, commissionaires, clerks, typists and office errand boys (B. 50).

2. Manufacture of flexible metallic tubing in cold rolling process or cold galvanising under electric process, in joining up lengths of india-rubber and picking out foreign matter from asbestos thread and in corrugating ribbon metal and forming it into metallic tubing (B. 184).

3. Rolling, drawing, annealing and pickling seamless steel tubes (B. 200).

4. Storekeepers' assistants (B. 285).
5. General labourers in packing and warehouse department (B. 286).
6. Manufacture of tubes from strips and solids and wholly or mainly engaged in grinding (B. 295).
7. Manufacture of non-conducting composition for boilers and steam pipes (B. 296).
8. Making steel welded barrels, drums and tanks not forming part of the structure of buildings, vehicles, machinery or works (B. 308).
9. Making picks, hammers, shovels, &c. (not being iron founding), and wooden handles for such tools (B. 310).
10. Workmen in steel works—working boiler-feed pumps, boiler firers, coal elevator men, hydraulic engine men, men in charge of engines producing power, and switchboard attendants, men at hydraulic presses, rolling mills, and furnaces, and cranemen (B. 541).

Electrical Engineering.—Contributions *are* payable in respect of workmen engaged in, or as—

1. Installation and maintenance of electrical machinery and conductors; manufacture and assembling of main switchboard parts and the erection of main switchboards, including rheostats, controllers, contactors, and brush gear (excluding the winding of coils in all cases); manufacture of parts of commutators and collectors; toolmakers making tools for use in connection with the manufacture of any of the before-mentioned instruments or apparatus (A. 280).
2. Toolmakers employed in the tool department of electrical engineers making tools for telephone apparatus manufacture (A. 342).
3. Toolmakers and machine setters manufacturing electric light accessories (A. 343).
4. Testers of machinery wholly or mainly manually employed (A. 346).
5. Manufacture of steel and metal balls for bearings and ball and roller bearings (A. 353).
6. Painting machines finished by erectors (A. 356).
7. Construction, reconstruction, or alteration of electrolytic plant. In the opinion of the umpire "alteration" refers to work which involves a substantial change or variation in the original design (A. 374).
8. Wiremen engaged in wiring for electric lighting and bells in buildings (A. 194).
9. Manufacture and assembling of main switchboard parts, electrician and wiremen running wire tubing, &c., to buildings (A. 516).
10. Electrical wiremen installing electric light or bells on ships (A. 695).

Contributions *are not* payable in respect of the following :—

1. Manufacture of accumulators and electrical batteries (B. 4 and 5).
2. Casting and finishing electric light fittings in brass or other copper alloy in connection with buildings, ships and vehicles (B. 49).
3. Joinery, sawmilling and wood-turning in connection with electric light fittings and accessories (B. 344).
4. Slate and metal enamellers and lacquerers of brass or other metals in connection with electric light fittings (B. 345).
5. Repairing electrolytic plant not being machinery (B. 373).
6. Softening a compound (made of asbestos and gum) on hot plates, and placing same in dies and moulds, which are closed or opened by machinery for electrical insulating material makers (B 109).
7. Storekeepers, shop-cleaners and odd men (B. 137).
8. Dismantling electric meters (B. 190-8).
9. Manufacture of telephone and telegraphic instruments and apparatus (B. 80-1).
10. Clerks, lady typists, storekeepers, assistants and canvassers (B. 140).
11. Packers, examiners or viewers of goods, goods carriers, and window cleaners (B. 364).
12. Preparation and repair of removable electric stoves (B. 190-5).
13. Making and assembling electric meters and arc lamps, including quartz and silica and glow lamps (B. 288).
14. Armature and coil winding, including the assembling and insulation of commutators and collectors, whether mica or other insulators (B. 288).
15. Manufacture of silk shades for electric light fittings, &c., cutting and sewing silk on to wire frames, and making wire frames (B. 413).
16. Installation of telephones (B. 426).
17. Telephone wiring and repairs (B. 471).
18. Adapting gas and candle fittings for electric light (B. 515-4).
19. Making parts and assembling magnetos and repairing same; making switches and cut-outs for motors (B. 518).
20. Making scientific instruments (other than tool makers) for wireless telegraphs or engaged in the maintenance and upkeep of machinery or buildings, superintending and assisting in superintending in the erection of stations (not manually employed) (B 528).
21. Manufacture of switchboards, switches and lamps for electric lighting or motor-cars and making switch-boxes (B. 530).
22. Making fuses from cut tubes made of fibre, &c., and filling same (B. 626).
23. Making and assembling metal parts of sparking plugs with porcelain and other insulators (B. 665).

Cables, Overhead Lines and Street Lighting.—Contributions are payable in respect of :—

1. Jointing new cables in electricity and tramway departments (191-4).
2. Work wholly or mainly in connection with overhead, third rail, conduit, surface contact or cable equipments of railroads, tramways, light railways or electric power supply, the cost of which is usually chargeable to capital account (A. 191-6). *Note*—this does not include services.
3. Manufacture and assembling of parts of electrical distribution appliances such as feeder boxes and pillars, joint, network and service boxes, &c., in the mechanical engineering department of a cable and construction company (A. 679).

Contributions *are not* payable in respect of :—

1. Manufacture of electric cables (B. 80).
2. Setting up poles to be used solely for electric lamps for street lighting purposes (B. 190-3).
3. Repairing and maintaining overhead third rail conduit, surface contact or cable equipments of railroads, tramways, light railways or electric power supply, the cost of which is usually chargeable to revenue account (B. 190-4).
4. Making lamp irons and bolts for erection of lamp pillars (B. 190-7).
5. Repairing electric controllers for lighting and extinguishing lamps (B. 190-9).
6. Laying services (B. 190-10A).
7. Laying mains, the cost of which is usually chargeable to revenue account (B. 190-10B).
8. Jointing cables for repairing or taking branches from mains in consumers' premises (B. 190-15).
9. Finishing and assembling cable accessories for underground and for use in consumers' premises (B. 190-17).
10. Draughtsmen (B. 264).
11. Labourers unloading cable (B 515-3).
12. Painting street lamps (B. 547).
13. Handling, preparing and creosoting telegraph poles and other timber (B. 650).
14. Wood machinists making arms for telegraph and telephone poles and cabinets, casing and covers for electric light wires, cabinet work for telephones, packing cases, &c. (B 687).

Note.—The Board of Trade propose to make a general order exempting drivers and attendants of any vehicle and stablemen or other workmen employed in tending horses or cleaning any vehicle.

Generation and Supply of Electrical Energy.—Contributions *are* payable in respect of—

1. Pipe fitters maintaining and up-keeping steam pipe lines (A. 258-2).
2. Electricians employed by dyers and cleaners in the fixing and upkeep of electric lighting plant (A. 326).
3. Electricians employed by flour millers wholly or mainly in the maintenance and repair of electrical machinery and conductors (A. 330), and in the electric wiring for buildings (A. 193).
4. Smiths and mechanics and their labourers engaged

wholly or mainly in the maintenance and upkeep of machinery (A. 58).

5. Cranemen employed in repairing shops in electricity and tramway departments engaged wholly or mainly in lifting materials for repairs of machinery (A. 191-1).

6. Carpenters engaged in constructional woodwork and general repairs to buildings, engine fitters, labourers, moulders, moulders' mates, machinists attending to machine tools, painters, plumbers and mates, timbermen and scaffolders (A. 265).

Contributions *are not* payable in respect of—

1. Switchboard, motor-generator and battery attendants, installation and arc lamp testers and meter readers (B. 10).

2. Dynamo and electric motor attendants not wholly or mainly engaged in the maintenance and upkeep of machinery (B. 24-5).

3. Repairing railway sidings (B. 190-11).

4. Repairing electric meters (B. 190-16).

5. Ash cleaners, boys (porterage and general cleaning), coal trimmers, labourers and measurers, condenser attendants, dynamo cleaners, engine drivers and cleaners, foremen, greasers, gate and timekeepers, instrument and meter testers and calibrators, inspectors, loco. drivers, lamp trimmers, regulators (switchboard and battery attendants), storekeepers and assistants, shop boys, shift engineers, substation attendants, transformers and dynamo attendants, water softener attendants, water and pump attendants, box inspectors, camp boys, chauffeurs, installation inspectors, street lighting attendants, yardmen, clerks, canvassers, collectors, chefs, messroom attendants, lavatory attendants, carmen, draughtsmen, lightermen, lift attendants, office cleaners, typists, telephone girls, window cleaners, and chemists (B. 264).

6. Cleaning lights on roofs of works; washing of motor-cars (B. 165).

7. Motor tire repairers, petrol storekeepers and caretakers (B. 172).

8. Cleaning, overhauling, repair, and general maintenance of arc and incandescent lamps, carpenters and assistants making removable meter brackets, fuse hands, boiler cleaners and wiremen fitting up temporary wires and appliances in showrooms, making joints and carrying out experiments and tests (B. 455).

9. Crane attendants, coal labourers, coal meterers and firemen (B. 488).

10. Scaling stationary boilers, economisers, &c., by hand or by pneumatic tools (B. 556).

11. Smelting refractory ores by electricity (B. 696).

Tramways.—Contributions *are* payable in respect of—

1. Bricklayers, slaters and labourers of each, employed by a tramway company, engaged wholly or mainly in the construction, alteration, repair and decoration or demolition of buildings (A. 26).

2. Wholly or mainly employed in the construction, reconstruction or alteration of tramway lines (A. 221).

Contributions *are not* payable in respect of—

1. Repairing tramway lines and repairing a working tramway line (A. 220).

Buildings.—Contributions *are* payable in respect of—

1. Bricklayers, carpenters, joiners, plumbers, painters, scaffolders' plasterers, and the labourers of each engaged, wholly or mainly, in the construction, alteration, repair, decoration or demolition of buildings (A. 54).

2. Whitewashers and decorators (Note to B. 364).

Works of Construction.—Contributions *are* payable in respect of—

1. Workmen employed by a firm of contractors who are engaged in generating and distributing electrical power for the purposes of works of construction (A. 393).

In some cases the decisions of the Umpire refer to a local authority or a company, or to some specified trade, but they may be taken to apply *mutatis mutandis* to any of these; and when the above are considered in conjunction with the Schedule, it will be found that the above list is fairly exhaustive, but should any difficulty be found, or should no decision have been given, application should be made to the Umpire. The address to which all applications should be made is 47, Victoria Street, Westminster, London, S.W.

BOILER SETTINGS.

By EDWARD INGHAM, A.M.I.M.E.

Whilst, generally speaking, almost every attention is given nowadays to the design and arrangement of the steam plant at electric generating stations, there is one matter, viz., the setting of the boilers, which certainly does not always receive the careful consideration which its importance demands. As a result, not only is the efficiency of working less than it might be, but the "wear and tear" of the boilers is increased, not infrequently to a very considerable extent.

In order that the maximum of efficiency and the minimum of "wear and tear" may be obtained from a steam boiler, it is absolutely necessary that the boiler be set properly. Hence a few remarks on this important, though somewhat neglected subject, will, it is hoped, be of use.

The first consideration is, of course, the selection of a suitable site. Low and damp situations should as far as possible be avoided, because, as every engineer knows, there is nothing more liable to cause rapid deterioration of steam boilers than external dampness, particularly if the setting is in any way defective. It sometimes happens that the site is below the level of a canal or at the foot of a hill, so that water can drain downwards into the foundations. If then the latter are below the level of the drains, the setting will be constantly damp, and severe external wasting is then very liable to be set up. Under such circumstances, a good concrete foundation should be provided, and should there be any likelihood of moisture passing through the walls of the setting, it is a good plan to extend the concrete bed at the sides up to the outside ground level. Another effectual expedient, when the foundations are below the level of the drains, is to dig a well in the vicinity of the boilers, suitable arrangements being made for draining the water which collects in the foundations into this well. The well would, of course, require to be emptied from time to time of its water.

The thickness of the concrete, which material, by the way, is the best on which to build the setting, depends on the nature of the foundation, and may, indeed, be anything from 9 in. to 24 in. A usual thickness for clay, say, or ordinary firm earth, is 12 in.

One of the principal sources of loss in the working of steam boilders is radiation of heat from the hot surfaces. In the case of exposed surfaces this is usnally prevented to a large extent by means of non-conducting porous composition. Some provision against loss from radiation should, however, also be made in the walls of the setting by means of an air cavity. As is well known, air is one of the best insulators or non-conductors of heat, and if therefore an air space is built into the walls, the loss from radiation may be reduced very considerably. The makers of the well-known and deservedly popular Poulton setting, in addition to providing an air space in the walls, also provide one underneath the boilers by means of special anti-radiation serrated bricks, with the object of preventing radiation through the foundations. The importance of this additional air space is well illustrated by the following:—"At a large electric lighting and power station, where a range of 10 boilers is installed, the temperature of the clay underneath the concrete, 10 ft. below the bottom of the boilers, was found to be as much as 280° F. The boilers were worked night and day, and were provided with forced draught arrangements. An immense mass of material was thus maintained at this high temperature day and night by a direct waste of valuable heat."

In order to provide, say, a 2-in. cavity in each of the side walls, more space is required, and at electric power stations, where large ranges of boilers are concerned, and where space is frequently a most important consideration, this becomes a serious item. In such cases, special serrated bricks are of great use, as by their adoption much saving in ground space may be made.

As a further preventive against radiation losses, the brick walls may, if it is thought worth the extra expense, be carried up to the boiler tops, and then roofed over so as to form a hot air chamber.

This question of preventing heat radiation losses is always

an important one, but at electric generating stations this is especially the case, because at such places, the boilers may be worked for only a short time each day, and the loss then becomes a serious item.

The practice of facing the front walls of the setting with white enamelled bricks is one which is to be recommended. Although this entails additional expense (the cost of the enamelled bricks being many times that of ordinary bricks), the extra expense will be more than compensated for in other ways. The boiler house is made to look bright and cheerful, and as a result, the men in charge of the plant take a keener interest in maintaining the general upkeep and condition of the boilers and setting.

Probably the most important consideration in the setting of steam boilers is the extent to which the boiler plates are hidden or covered by those parts of the setting which are in actual contact with the plates. At one time, it was quite common to make the seatings and flue covers of Lancashire boilers of great width, often as much as 12 or even 18 in. wide at the parts in contact with the plates. Such wide bearing surfaces as this are extremely objectionable, because not only is much useful heating surface lost, but a large area of plate is covered over, and hence complete inspection of the boiler cannot be made. Further, external corrosion is especially liable to occur at parts covered by brickwork, and unless, therefore, the plates are bared frequently, the wasting may proceed undetected until the condition of the boiler becomes dangerous. Nowadays, the bearing surfaces are made much narrower than formerly, but even now, considerable improvement might, in the majority of cases, be made. Thus the thickness of the seating blocks at their bearing edges is generally about 3 in., but as a matter of fact, a thickness of one-half this, viz., 1½ in. is ample—in fact, much more than sufficient to support the heaviest Lancashire boiler even when filled with water.

Every part of the setting which is in contact with the boiler plates should be reduced to the absolute minimum; it seems absurd to adopt 3-in. bearing surfaces, as is generally done at the present time, when a width of 1 in. is sufficient. In the "Poulton" setting, all parts which come in contact with the boiler plates are made of a rounded form, so that there is practically no surface of plate covered over. In this way a maximum of heating surface is obtained, whilst every part of the boiler, so far as the setting is concerned, is open to inspection. With the ordinary type of setting it is generally necessary to plough through the seatings and flue covers occasionally, especially at the seams, in order that a thorough inspection may be made. This ploughing may be avoided by cutting away a portion of the upper part of the seating blocks where these are crossed by the ring seams, and fitting into the openings thus made loose pieces of fireclay; the loose pieces can then be readily removed at any time for inspection purposes.

A good form of setting is made by the Adjustable Cover and Boiler Block Co., who keep the width of all bearing surfaces small, and construct the flue covers so that these may be readily lifted, thus allowing the plates to be fully inspected at any time. In some instances the ordinary flat-topped seating blocks and flue covers are fitted with a piece of asbestos rope, the boiler being made to rest on the rope, and not on the block. In this case no heating surface is lost, and the asbestos forms an effectual means for preventing air leakage into the flues.

Special attention should be given to the size of the flues, which must be made large enough to permit of a man readily passing through them for cleaning and inspection purposes. The side flues of Lancashire boilers should be not less than 9 in. wide at the narrowest part, but 12 in. is preferable. The bottom flue is usually made about 2 ft. 6 in. deep and about half the diameter of the boiler in width.

Seating blocks and flue covers should be made of specially prepared fireclay blocks, whilst all parts of the flues which are exposed to the action of the hot furnace gases should be lined with a good quality of firebrick, the lining being well keyed in. With water-tube boilers (the type now most used in power stations), the question of using firebricks of high heat-resisting qualities, is one of great importance. This is especially the case where machine stoking and forced draught are employed. Under such circumstances, an intense heat, almost equal to that in a reverberatory furnace or a puddling furnace is obtained, and in one instance with which the writer is acquainted, the heat was so intense that the cast-iron soot doors and frames at the back end of the boiler actually melted, and when the boiler was laid off for cleaning, the melted metal hung down like icicles. Such intense heat as this naturally has a destructive effect on the fire-brick arches, especially of water-tube boilers settings, and for such purposes any but the very highest quality of fire-brick is quite useless.

Good fire-bricks, in addition to being capable of withstanding high temperatures without becoming fused or disintegrated, are good non-conductors of heat, and hence a refractory fire-brick lining also serves to prevent to a large extent, loss of heat by radiation through the setting. Good fire-bricks seem to acquire a glazed surface after exposure to high temperatures, and thus reflect back the heat of the furnace, for, as is well known, bright surfaces have a tendency to reflect heat.

Fireclay, and not mortar, should be used for the jointing material, especially for such parts of the setting as are exposed to the hot gases, or come into contact with the boiler plates. Mortar, like ordinary brickwork, is porous, and readily absorbs moisture, so tending to set up external corrosion of the boiler plates, and it also quickly breaks up. This is not the case with fireclay, which is, therefore, much more suitable as a jointing material.

Other points requiring attention in the building of the setting are the avoidance of cavities and chambers in which explosive mixtures might collect and the doing away, as far as possible, with local contractions, sharp bends, &c., in the flues. No part of the flues should be less in sectional area than the area of the throat of the chimney, which is usually not less than one-eighth the area of the fire-grate.

A boiler will often work satisfactorily, even when the flues are cramped and restricted, so long as it is only required to work at comparatively low power. When, however, extensions of the steam plant are made, and the boiler is called upon to develop its full power, it is unable to do so. The results of this may be very serious, for it is generally a difficult matter to remedy the evil; hence the importance of building the flues of ample capacity in the first instance.

In Lancashire boilers a mistake sometimes made is to build the firebridges too high. Such a mistake is liable to seriously cripple the draught, and in one or two instances which have come under the writer's notice it has been impossible to maintain steam in consequence. The removal of one or two layers of bricks has entirely remedied the evil. Generally speaking, a distance of not less than 10 in. should be left between the tops of the bridges and the furnace crowns at the middle.

In conclusion, the importance of entrusting the work only to men who have had special experience in boiler setting cannot be too strongly urged. Defective brickwork is a constant source of annoyance and expense, and is one of the most fruitful sources of low efficiency in the working of steam boilers. If the work is indifferently carried out, short-circuiting of the flue gases from one flue to another, and various other troubles, are liable to be experienced.

Defective setting no doubt explains why boilers built to exactly the same specifications, and by the same firm, often give such widely different results when put to work, even though they may be working under apparently identical conditions.

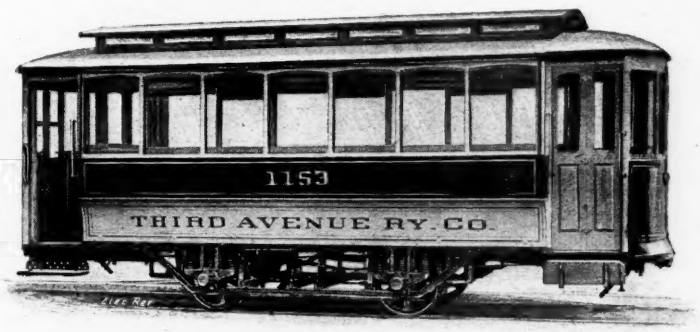
Explosives in Coal Mines Order.—The following notice is issued from the Home Office:—"The question having been raised whether the words 'magneto-electrical apparatus' as used in the Order of May 21st last include what is known as a 'dynamo exploder,' *i.e.*, an electrical firing apparatus consisting of an armature rotating in a permanent (non-electrical) magnetic field, as well as the form in which an armature rotates in a field formed by an electromagnet, the Secretary of State wishes it to be generally known that it was intended to include apparatus of both kinds, and he is advised that the phrase used does, in fact, include apparatus of both kinds.

"With regard to the requirement in Clause 2 (*h*) of the Order that every electrical firing apparatus shall be provided with a push button, an internal arrangement by which the firing contact is automatically made at the end of the travel of the handle, and on the release of the handle is immediately broken, performs the same function as a push button, and will be admitted as complying with the requirement in the Order as to the provision of a push button."

AN INTERESTING STORAGE BATTERY CAR.

The problem of the storage battery car has nowadays received a renewed amount of attention on account of the possibilities which are being afforded by the lighter types of storage batteries which are now available, and in the United States considerable practical experience has already been gained in the construction and operation of such cars, which can with advantage be studied by engineers on this side of the Atlantic. It is, therefore, of interest to discuss briefly the storage-battery cars which are now being used by the Third Avenue Railroad of New York City, inasmuch as these operate over some of the lines which were previously served by horse cars; altogether over 60 cars have been put into commission for this purpose. The development was not made in a hurry, inasmuch as the initial number of battery cars in use was only five on this particular line, so that it can be said that the first cars, at any rate, operated so satisfactorily as to justify the extension of the experiment to the large scale now indicated. In fact, it may be said without much fear of contradiction that the matter has progressed from the experimental stage into one of practical working operation.

Fig. 1 shows the general external appearance of these cars, which are built by the J. C. Brill Co., of Philadelphia. The trucks are designed to allow the batteries to be placed under the body if desired, and whereas in the earlier type chain gearing was adopted, in the later cars ordinary railway motor gearing has been employed. The motor equipment consists of two 4½-H.P. General Electric motors furnished with axle bearings, the gears eliminating all maintenance trouble due to the driving mechanism, and taking up perceptibly less space than the chain drives formerly used. Cast-steel wheels are used with anti-friction journal bearings. The new cars have a length over the vestibules of 26 ft. 1½ in., the body being 18 ft. long. The width overall is 7 ft. 6 in., and the length over the sill is 6 ft. 5½ in. The height to the sills is 2 ft. 5½ in., and the height from the sills to the roof is 8 ft. 2½ in. The longitudinal seats accommodate 30 passengers, and each of the new cars is equipped by the Electric Storage Battery Co., with Hycap-Exide batteries having a rating of 420 ampere-hours. These batteries are supplied under a maintenance guarantee of five years, during which period the output has not to fall below 75 per cent. of the original rating. The future progress of these cars, especially with regard to the maintenance of the battery and the cost per car-mile, will be watched with considerable interest on this side, and it is to be hoped that further figures will be available after greater running experience has been obtained.



New York Storage Battery Car.

Electric Cheese.—A Dutch farmer claims to be able, by passing a current through them, to mature cheeses in 24 hours. The process has hitherto been very slow.

ENGINEERING AND MATHEMATICS.

[communicated.]

Those responsible for the design of machinery are practically unanimous in their desire to avoid mathematics and complex formulæ; it is only the inexperienced student who endeavours to apply such means where simpler methods would be quicker and equally satisfactory.

If the data at our disposal were accurate, it would be possible to use formulæ giving precise results, but, unfortunately, the measurements, weights and quality of the materials used in the construction of machinery are only approximate, hence the prediction of exact results from any given combination is impossible. On his first acquaintance with *electrical* apparatus, the novice is inclined to assume that a knowledge of theory is sufficient to enable him to design a dynamo or motor. This assumption is entirely erroneous, and it is doubtful whether any other class of machinery demands so much experienced judgment for its successful design. It is impossible to obtain homogeneous materials; the iron or steel for the magnets will vary in quality, the armatures often differ slightly with different consignments of disks, the gauge of wire and the thickness of the insulation are never exactly to specification, and many other factors enter into the calculations, for which allowances based upon practical experience have to be made. Such being the case, it would be a waste of time to complicate the calculations for the sake of ensuring extreme accuracy, when the results are certain to be vitiated by faulty data; hence simple formulæ are used by practical designers, which give only approximately correct figures for output, efficiency, temperature rise, &c.

To professors and others whose calling involves the investigation of the principles underlying the design of machinery, a good knowledge of mathematics is essential; also the mathematical training of engineering students should include the study of more complex problems than they are likely to meet with in after experience, but the professors should endeavour to simplify their calculations and formulæ so as to make them suitable for commercial application, whilst students should not attempt to advertise their attainments in the columns of the technical press or before the members of the engineering institutions.

Text-books, in which practical problems are treated by the aid of complex formulæ have a very limited application. The practical designer will not look at them, and the student is likely to waste time puzzling out problems which could be presented in a much simpler and more useful form. These strictures also apply to articles and papers of a similar nature, some of which, in all probability, are never read by anyone.

It is astonishing how unwilling are the readers of technical papers to use their brains over any article which is difficult to understand, and this attitude extends to some extent to the editorial staff. Some years ago, the writer came across an article which, although it involved no considerable knowledge of mathematics, was necessarily of a complex nature owing to the subject dealt with. This article appeared in one of the leading engineering journals (not the Electrical Review), and by reason of a misunderstanding with the editor over certain additions, parts of it were reduced to absolute nonsense. The subject was apparently not understood by the editor, or his assistant who presumably perused it, otherwise publication must have been postponed pending revision. As regards the readers of the aforesaid journal, reference to the "Correspondence" columns indicates that many of them are quick enough to point out mistakes when opportunity occurs, yet in this instance no letter to the editor was forthcoming.

It is to be feared that articles of this nature are sometimes accepted on the strength of the writer's reputation, and this course would appear to be a safe one where the subject has been treated in a manner difficult to understand.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,519. "Apparatus for measuring the electric conductivity of liquids." M. COPLANS. July 29th.

17,583. "Electrical welding apparatus." DUNLOP PNEUMATIC TYRE CO., LTD. and F. J. KEEGAN. July 29th.

17,618. "Manufacture of electric pig iron." V. STOBIE. July 30th.

17,623. "Electrical conduit fittings." L. G. BYNG and T. TAYLOR. July 30th.

17,634. "Electrically operated time-limit detonator for use in blasting and such like operations." W. R. ASH, C. DALLEY and W. S. TOPLIS. July 30th.

17,651. "Electromagnets." H. LEITNER. July 30th.

17,663. "Electrodes for use in arc lamps." A. A. LOW. July 30th. (Complete).

17,678. "Electrodes for use in arc lamps." A. A. LOW. July 30th. (Complete).

17,680. "Protective devices for electric circuits." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 30th.

17,701. "Method of producing conducting films upon the surfaces of electrical apparatus." L. D. REAY. July 31st.

17,749. "Method of and apparatus for electric welding." R. HADDAN. (Cleveland Welding and Manufacturing Co., United States.) July 31st. (Complete.)

17,752. "Electric hand apparatus for producing light." W. E. LAKE. (Fabrique Internationale D'Appareils a Magneto S.A. (F.I.A.M.), Switzerland). July 31st.

17,779. "Electric striking gear." H. CAMPICHE. (Convention date, August 1st, 1911, Switzerland.) July 31st. (Complete.)

17,805. "Electrically-actuated automatic door-operating appliances." J. J. REYNOLDS and P. C. LARMUTH. August 1st.

17,836. "Electrolytes for use in electrometallurgy." N. H. M. DEKKER. August 1st. (Complete.)

17,837. "Heating apparatus." R. WEAVING and FERRANTI, LTD. August 1st.

17,838. "Self-regulating dynamo-electric machines." C. A. VANDERVELL and A. H. MIDGLEY. August 1st.

17,840. "Process and apparatus for the electrical separation of bodies in suspension from electrically insulating fluids, more particularly gases." E. MOLLER. August 1st. (Complete.)

17,850. "Portable electric hand-lamps." A. H. HUNT. August 1st. (Complete.)

17,858. "Automatic telephone exchange switches and controlling circuits therefor." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) August 1st. (Complete.)

17,864. "Insulating boots and shoes." J. H. C. BROOKING and ST. HELEN'S CABLE AND RUBBER CO., LTD. August 1st.

17,871. "Electric accumulator." S. F. THOMPSON and E. R. THOMPSON. August 2nd.

17,918. "Fire-alarm apparatus and circuit arrangements." A. C. BROWN and G. A. EDWARDS. August 2nd.

17,942. "Magnetic speedometers." J. K. STEWART. August 2nd. (Complete.)

17,951. "Production of artificial resinous substances." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) August 2nd.

17,952. "Method of separating magnetic from non-magnetic powdery materials, such as iron, sands, and the like." S. L. ELBORNE and H. GODSAL. August 2nd.

17,955. "Telegraphic relays." A. MUIRHEAD and F. L. MUIRHEAD. August 2nd. (Complete.)

17,978. "Telegraph receiving apparatus adapted to split up incoming signals into their components, and to actuate a transmitter or analogous device, or to perforate a tape according to either the Wheatstone, cable, or other systems of working." A. FRASER, K. L. WOOD and EASTERN TELEGRAPH CO., LTD. August 3rd.

17,980. "Resistances." J. ROOTHAAN and FERRANTI, LTD. August 3rd.

18,013. "Electrical driving of ring-spinning and doubling frames." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens Schuckertwerke G.m.b.H., Germany.) August 3rd. (Complete.)

18,017. "Electric heaters." H. H. GRUNDY. August 3rd. (Complete.)

18,025. "Electrical generating set." J. A. REY. August 3rd. (Complete.)

[CORRECTION.—The number of the patent for "Recording instruments and the like" (EVERSHED & VIGNOLES, LTD., and G. W. BINSTEAD), appearing in this column of our last issue, should be 17,226, not 17,214, as printed.]

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

ELECTRIC ACCUMULATOR. K. R. Smith. 13,758. June 9th. (December 8th, 1911.)

TRACTION ELECTROMAGNETS. H. W. Lake. (D. L. Lindquist.) 16,374. July 15th.

SPARK PLUGS. J. W. Mackenzie. (Champion Ignition Co.) 16,438. July 17th.

ELECTRIC LIFTS. W. H. Scott. 16,532. July 18th.

COVERING OF ELECTRIC CONDUCTORS WITH PLASTIC MATERIAL AND APPARATUS THEREFOR. W. S. Smith and A. D. Shuter. 16,542. July 18th.

APPARATUS FOR RECORDING TELEPHONE CALLS. C. C. Chapman and A. Grimsley. 16,558. July 18th.

MANUFACTURE OF ELECTRIC ACCUMULATOR ELECTRODES, AND MEANS FOR USE THEREIN. R. Pape. 17,132. July 26th. (Patent of Addition not granted.)

ELECTRIC SWITCHING DEVICES. H. S. Hatfield. 17,286. July 28th.

METHOD FOR TIMING TELEPHONE CALLS. T. Doddrell. 17,685. August 3rd.

ELECTRIC POWER TRANSMISSION DEVICES. H. Kleinschmidt. 18,051. August 9th.

ELECTRICAL IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. A. H. Midgley and C. A. Vandervell. 21,441. September 28th.

ELECTRIC FUSE. R. C. Hall. 22,844. October 17th.

LONG TUBULAR METALLIC-FILAMENT ELECTRIC LAMPS. H. E. Angold and J. F. Poynter. 24,250. November 1st.

MICA AND SUCH LIKE INSULATORS AND SCREENS, AND THE MANUFACTURE OF THE SAME. W. McLoughlin. 27,759. December 11th.

ELECTRO-OSMOTIC PROCESSES. Ges. für Elektro-Osmose. 28,185. December 14th. (September 28th, 1911.)

ELECTRICITY-CONTROLLING SWITCHES. Soc. H. Lapipe and C. Wittmann. 28,711. December 20th. (December 20th, 1910.)

ELECTRICALLY-OPERATED VALVES FOR GAS CONDUITS. W. Thiem. 29,140. December 27th. (June 17th, 1911.)

1912.

COMBINED PERCUSSION AND ELECTRIC PRIMERS FOR QUICK-FIRING GUNS. Soc. Anon. John Cockerill and E. Ternström. 9,289. April 19th. (Addition to 4,990 of 1912.)

ELECTROLYTIC PROCESS FOR CLEANING METAL ARTICLES. Langbein Peanhauser Werke Akt.-Ges. 9,609. April 23rd. (April 25th, 1911.)

ELECTRIC-SIGNALLING APPARATUS. V. H. Street. 9,936. April 26th.

ARC LAMPS. C. Weber. 10,737. May 6th. (May 5th, 1911.)

PROTECTIVE ARRANGEMENTS FOR USE IN CONNECTION WITH ELECTROLYTIC VALVES OR POLARISATION CELLS. G. Liebe. 11,366. May 13th. (May 31st, 1911.)

APPARATUS FOR THE ELECTRO-OSMOSE METHOD. Ges. für Elektro-Osmose. 725. January 9th. (October 2nd, 1911.)

STABILISING VOLTAIC ARCS. C. E. Guye. 804. January 10th. (January 10th, 1911.)

MANUFACTURE OF ELECTRIC INCANDESCENT LAMPS. Deutsche Gasgluhlicht Akt.-Ges. (Auer-Ges.) 874. January 11th. (May 11th, 1911.)

COOLING ARRANGEMENTS FOR DYNAMO-ELECTRIC MACHINERY. Siemens Bros. Dynamo Works, Ltd. (Siemens & Schuckertwerke Ges.) 2,106. February 7th.

ELECTRICAL WARP STOP-MOTIONS FOR LOOMS. D. Schatz. 3,114. February 7th.

ELECTRIC INCANDESCENT LAMPS. Deutsch Gasgluhlicht Akt.-Ges. (Auer-Ges.) 3,840. February 15th. (November 4th, 1911.)

APPARATUS FOR CONTROLLING AND RECORDING THE CONSUMPTION OF ELECTRICAL ENERGY. H. Gottschalk. 4,791. February 26th.

ELECTRIC SIGNAL OR INDICATOR FOR TAXIMETER CABS OR OTHER SIMILAR PUBLIC VEHICLES. P. T. Hillman. 5,534. March 5th.

PRESS-BUTTON ELECTRIC SWITCHES. H. Wischhusen and A. Hepke. 7,795. March 30th. (April 1st, 1911.)

TELEPHONIC HEAD GEAR. E. A. Graham. 10,041. April 27th.

BULBS FOR ELECTRIC GLOW-LAMPS. H. Gethe and Gluhlampenfabrik Hansa Ges. 10,346. May 1st.

SPARKING PLUGS. C. E. Johnson. 11,311. May 13th.

Wind Power and Electricity.—The problem of how to derive a supply of electrical energy from the wind has always had a certain fascination for electrical engineers. Unfortunately, although at first sight it does not seem a difficult matter to devise some system of wind vanes coupled with a generator and a storage battery which would work well and cheaply, there are many difficulties of a practical nature in the way. Some intermediate storage system must be used with a view to obtaining a constant source of power no matter what may be the fluctuations of the wind, the point being that such storage device should come between the wind vanes and the dynamo, instead of between the dynamo and the distribution system, as would at first sight appear desirable. A recent patent is for a system of generating electricity in which a petrol engine is used in conjunction with a wind motor. Both these prime-movers are designed to work on the same shaft, and they are connected together by means of a clutch. The load is taken up by the engine, and the windmill, as soon as the wind serves, adds its power to the shaft. Should the wind rise above a certain predetermined velocity, the wind vanes commence to take charge, as it were, and speed up the engine. A centrifugal governor then cuts out the ignition, thus shutting off the engine power. Should the wind drop, the ignition circuit is opened automatically, and the engine again takes the load. In this case it is difficult to see what advantage is derived from the use of the windmill. It would seem a far better arrangement if the governor, instead of working on the ignition, worked on the engine throttle and controlled the supply of vapour. The windmill and engine would then work in parallel when the wind power was insufficient to drive the generator by itself, and there would be a considerable saving in paraffin or petrol.

As an illustration of a storage method a plant may be mentioned in which power from a windmill is combined with water power in the following manner:—A 14-ft. windmill is coupled by gearing to a large plunger pump, which draws water from a pond and delivers it to a tank of large capacity; the water, when power is desired, is allowed to flow through a small turbine, of ½-H.P. capacity, which is direct-coupled to a ¼-H.P. dynamo. The current from this, which is generated at 25 volts, is used to charge up an 11-cell storage battery, which is capable of supplying 20 8-C.P. metal-filament lamps for three hours, according to a statement made by the firm who installed the plant.

By means of certain automatic hydraulic devices, practically all the energy which the windmill can produce is stored up, and it is stated that with the equipment mentioned sufficient electricity for winter use can be obtained by allowing the windmill to work for an average of five hours per day. Of course, during the summer months less electricity is used for lighting purposes, and an average of two hours' run per day is amply sufficient.